Vol. 9, No. 7
April 15, 1984

Energy Research Abstracts

Abstracts 11400-13084

Technical Information Center
Office of Scientific & Technical Information
UNITED STATES DEPARTMENT OF ENERGY

CURRENT AWARENESS PUBLICATIONS ON ENERGY

To provide complete coverage of literature related to major Department programs, announcement publications that are comprehensive in their coverage of certain energy fields are issued regularly. All information in these publications, plus additional backup information, is included in the Energy Data Base of the Technical Information Center; all references are also available for machine searching via the on-line retrieval system, DOE/RECON, and the commercial on-line retrieval systems. Descriptions of these current awareness publications, which are supported either directly or indirectly by the DOE, appear below. Department of Energy components may receive the listed publications free from the Technical Information Center, P. O. Box 62, Oak Ridge, TN 37831. Telephone (615) 576-1303; FTS 626-1303.

PUBLICATIONS OF THE TECHNICAL INFORMATION CENTER

Energy Abstracts for Policy Analysis (EAPA)

A monthly abstract journal devoted to the analysis of energy research, conservation, and policy. Scope and coverage are limited to substantive articles or reports and emphasize the following programmatic efforts; legislative, regulatory, and other legal aspects, social, economic, and environmental impacts; regional and sectoral analyses; institutional factors, etc. *EAPA* is available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402; domestic subscribers $6.00, foreign $7.50 per copy; annual cumulative index, domestic $10.00, foreign $12.50 per copy. The annual subscription price is $70.00 for domestic subscribers and $87.50 for foreign subscribers.

Energy Research Abstracts (ERA)

A comprehensive semimonthly abstract journal devoted to all areas of energy-related information produced by the Department of Energy, other U. S. government organizations, and foreign governments. *ERA* is available to the public on a subscription basis from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The subscription rate for the 24 semimonthly issues is $165.00 for domestic subscribers and $206.25 for foreign subscribers. A single issue costs $9.50 (domestic) or $11.90 (foreign).

DOE Patents Available for Licensing (PAL)

DOE is prepared to grant exclusive or nonexclusive, revocable licenses under DOE-owned U. S. patents and patent applications; this semiannual publication provides abstracting and indexing coverage of this literature. *PAL* is available on subscription as PB84-946800 from the National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, VA 22161. The annual subscription price is $14.00 for domestic subscribers and $28.00 for subscribers outside the North American continent; prices for single issues are $7.00 and $14.00, respectively.

The following monthly update journals are available to the public on subscription from the National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, Virginia 22161; use the identifying order number (PB- No.) when subscribing. The annual subscription rate for one volume (calendar) year (12 issues plus cumulative index) is $75.00 for domestic (North America) and $150.00 for foreign (outside North America) subscribers. A single issue is $7.00 (domestic) and $14.00 (foreign).

***Current Energy Patents (CEP)*–PB84-902800**

Provides coverage of the international patent literature, including patent applications, that concerns any aspect of energy production, conservation, and utilization.

***Energy and the Environment (EAE)*–PB84-914900**

Devoted to information on the impacts of energy-related activities and radioactive and nonradioactive pollutants on the environment.

***Fossil Energy Update (FEU)*–PB84-914600**

Devoted to information on the exploration, development, processing, and use of fossil fuels.

***Fusion Energy Update (CFU)*–PB84-915300**

Devoted to information on controlled thermonuclear fusion, including plasma and fuel research and power plant engineering and conceptual design studies.

***Solar Energy Update (SEU)*–PB84-914500**

Devoted to information on the utilization of solar energy, including biomass and tidal and wind power.

The following semimonthly bulletins are also available from the National Technical Information Service (NTIS). The annual subscription rate for one volume (calendar) year (24 issues; no indexes) is $40.00 for domestic subscribers and $80.00 for subscribers outside the North American continent; use the identifying order number (PB- No.) when subscribing.

***Acid Precipitation (APC)*–PB84-901000**

Covers all aspects of acid precipitation, including effects and possible control measures.

***Coal-Based Synfuels (CBS)*–PB84-901400**

Covers all aspects of conversion of coal into gaseous or liquid fuels.

***Coal Preparation and Pollution Control (CPC)*–PB84-900800**

Covers all aspects of coal preparation and cleaning and reducing pollution from its direct combustion.

***Direct Energy Conversion (DEC)*–PB84-946600**

Covers the following areas: photovoltaics, magnetohydrodynamics, electrohydrodynamics, thermoelectrics, thermionics, and fuel cells.

***Geothermal Energy Technology (GET)*–PB84-914700**

Devoted to information on the exploration, development, and utilization of geothermal resources.

***Laser Research (LAR)*–PB84-901100**

Covers all aspects of laser research and development, but excludes applications.

***Nuclear Fuel Cycle (NFC)*–PB84-913400**

Covers all aspects of the nuclear fuel cycle, both front end and back end.

***Nuclear Reactor Safety (NRS)*–PB84-913500**

Covers the following safety aspects: accident analysis, safety systems, radiation protection, decommissioning and dismantling, and security measures.

***Radioactive Waste Management (RWM)*–PB84-902900**

Covers the following management aspects: transport and storage, waste processing, waste disposal, waste storage, radioactive effluents, and shipping containers.

***Solar Thermal Energy Technology (STT)*–PB84-901200**

Covers research in materials, concentrators/receivers, salinity gradients, etc., for development of efficient and reliable solar thermal conversion systems.

***Unconventional Petroleum (UCP)*–PB84-901300**

Covers all aspects of secondary and tertiary recovery of petroleum and of oil shales and tar sands.

INTERNATIONAL ENERGY PUBLICATIONS

The Technical Information Center cooperates with the following organizations in the publication of international abstract journals: (1) International Atomic Energy Agency, International Nuclear Information System, Vienna, Austria, for *Atomindex;* (2) International Energy Agency, IEA Coal Research, London, England, for *Coal Abstracts;* and (3) International Energy Agency, Biomass Conversion Technical Information Service, Dublin, Ireland, for *Biomass Abstracts.* In each case, the cognizant foreign agency provides the non-U.S. information to TIC for inclusion in the Energy Data Base; in turn, TIC provides the U.S. information for input into the respective journal.

Atomindex

A semimonthly abstract journal providing worldwide coverage of information on nuclear science and technology. *Atomindex* is available by subscription from UNIPUB, 345 Park Avenue South, New York, NY 10010. The cost of an annual subscription, 24 semimonthly issues and semiannual and annual cumulative indexes, is $290.

Biomass Abstracts

A bimonthly abstract journal with comprehensive coverage of information in any step involved in the eventual conversion of biomass to energy. *Biomass Abstracts* is available free to Department of Energy components and contractors from the Technical Information Center. Non-DOE organizations may obtain *Biomass Abstracts* from Biomass Conversion Technical Information Service, Institute for Industrial Research and Standards, Ballymun Road, Dublin 9, Ireland, for 42 IR pounds per year. Make checks payable to the Institute.

Coal Abstracts

A monthly abstract journal providing comprehensive worldwide coverage of information in the field of coal science and technology. *Coal Abstracts* is available to Department of Energy components and contractors from the Technical Information Center. Non-DOE organizations may obtain *Coal Abstracts* from IEA Coal Research, Technical Information Service, 14-15 Lower Grosvenor Place, London SW1W 0EX, England, for 100 pounds sterling per year.

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ENERGY RESEARCH ABSTRACTS

ABOUT THE TECHNICAL INFORMATION CENTER

The Technical Information Center in Oak Ridge, Tennessee, has been the national center for scientific and technical information for the Department of Energy (DOE) and its predecessor agencies since 1946. In developing and managing DOE's technical information program, the Center places under bibliographic control not only DOE-originated information but also worldwide literature on scientific and technical advances in the energy field and announces the source and availability of this information. Whereas the literature of science is emphasized, coverage is extended to DOE programmatic, socioeconomic, environmental, legislative/regulatory, energy analysis, and policy-related areas. To accomplish this mission, the Center builds and maintains computerized energy-information data bases and disseminates this information via computerized retrieval systems and announcement publications such as abstracting journals, bibliographies, and update journals. Direct access to the Center's most comprehensive data base, the Energy Data Base, is available to the public through commercial on-line bibliographic retrieval systems. The Energy Data Base and many of the Center's energy-related data bases are available to DOE offices and contractors and to other government agencies via DOE/RECON, the Department's on-line information retrieval system. The Center has developed and maintains systems to record and communicate energy-related research-in-progress information, to maintain a register of DOE public communications publications, to track research report deliverables from DOE contractors, and to test and make available DOE-funded computer software programs with scientific and management applications. The Center also maintains a full-scale publishing capability to serve special publication needs of the Department. To effectively manage DOE's technical information resources, the Center's program is one of continual development and evaluation of new information products, systems, and technologies.

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ABOUT *ENERGY RESEARCH ABSTRACTS*

Energy Research Abstracts (ERA) provides abstracting and indexing coverage of all scientific and technical reports, journal articles, conference papers and proceedings, books, patents, theses, and monographs originated by the U. S. Department of Energy, its laboratories, energy centers and contractors. *ERA* also covers other energy information prepared *in report form* by federal and state government organizations, foreign governments, and domestic and foreign universities and research organizations. The user should remain aware that *ERA* coverage of non-report literature is limited to that generated by Department of Energy activity.

ERA is comprehensive in its subject scope, encompassing the DOE's research, development, demonstration, and technological programs resulting from its broad charter for energy sources, supplies, safety, environmental impacts, and regulation.

ERA is available on an exchange basis to universities, research institutions, industrial firms, and publishers of scientific information. Inquiries should be directed to the Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37831.

ERA is available to the public on a subscription basis from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The subscription rate for the 24 semimonthly issues is $165.00 for domestic subscribers and $206.25 for foreign subscribers. A single issue costs $9.50 (domestic) or $11.90 (foreign). The cumulative indexes will be available in printed form from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402, and in microfiche form from the National Technical Information Service, U. S. Department of Commerce, Springfield, Virginia 22161, and from Engineered Systems, P. O. Box 866, Oak Ridge, Tennessee 37831.

Published by the **United States Department of Energy, Technical Information Center**
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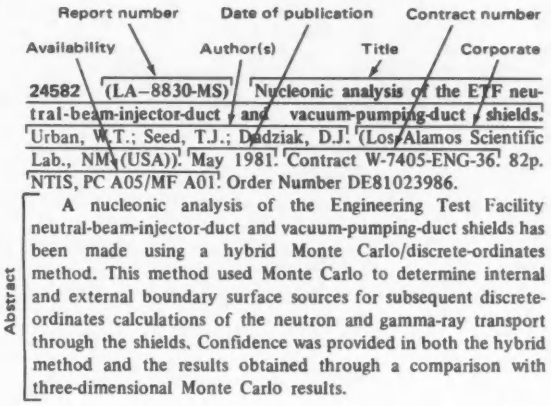
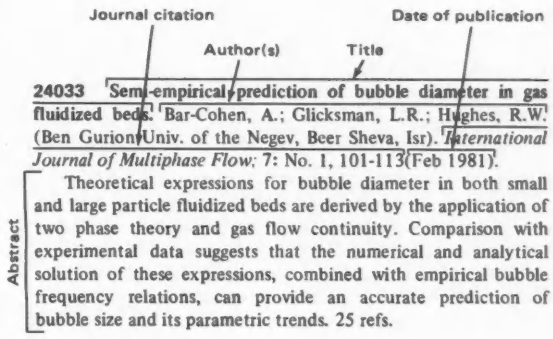
HOW TO USE *ENERGY RESEARCH ABSTRACTS*

ABSTRACTS IN *ENERGY RESEARCH ABSTRACTS*

The principal elements of abstract entries for a typical research and development report and a typical technical journal article are illustrated below.


Report number
Date of publication
Contract number
Availability
Author(s)
Title
Corporate
24582 (LA–8830-MS) Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields. Urban, W.T.; Seed, T.J.; Dudziak, D.J. (Los Alamos Scientific Lab., NM (USA)). May 1981. Contract W-7405-ENG-36. 82p. NTIS, PC A05/MF A01. Order Number DE81023986.
A nucleonic analysis of the Engineering Test Facility neutral-beam-injector-duct and vacuum-pumping-duct shields has been made using a hybrid Monte Carlo/discrete-ordinates method. This method used Monte Carlo to determine internal and external boundary surface sources for subsequent discrete-ordinates calculations of the neutron and gamma-ray transport through the shields. Confidence was provided in both the hybrid method and the results obtained through a comparison with three-dimensional Monte Carlo results.
Abstract


Journal citation
Date of publication
Author(s)
Title
24033 Semi-empirical prediction of bubble diameter in gas fluidized beds. Bar-Cohen, A.; Glicksman, L.R.; Hughes, R.W. (Ben Gurion Univ. of the Negev, Beer Sheva, Isr.). International Journal of Multiphase Flow; 7: No. 1, 101-113 (Feb 1981).
Theoretical expressions for bubble diameter in both small and large particle fluidized beds are derived by the application of two phase theory and gas flow continuity. Comparison with experimental data suggests that the numerical and analytical solution of these expressions, combined with empirical bubble frequency relations, can provide an accurate prediction of bubble size and its parametric trends. 25 refs.
Abstract

INDEXES TO *ENERGY RESEARCH ABSTRACTS*

Five indexes are provided for approaching the contents of each issue of *Energy Research Abstracts (ERA)*. Each index is preceded by an introduction that details the organization of the index and the principles by which it was compiled. The reader is referred to these introductions for information not found in the index examples that follow.

• Corporate Author Index

Technical report literature is indexed using the name of the organization or institution responsible for the issuance of the report.

24582 (LA–8830-MS) Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields. Urban, W.T.; Seed, T.J.; Dudziak, D.J. (Los Alamos Scientific Lab., NM (USA)). May 1981. Contract W-7405-ENG-36. 82p. NTIS, PC A05/MF A01. Order Number DE81023986.

is indexed as:

Los Alamos Scientific Lab., NM (USA)
Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields, 6:24582 (R:US)

• Personal Author Index

Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

Bar-Cohen, A., Semi-empirical prediction of bubble diameter in gas fluidized beds, 7:24033 (J:US)
Dudziak, D.J., *See* Urban, W.T., 6:24582
Glicksman, L.R., *See* Bar-Cohen, A., 7:24033
Hughes, R.W., *See* Bar-Cohen, A., 7:24033
Seed, T.J., *See* Urban, W.T., 6:24582
Urban, W.T., Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields, 6:24582 (R:US)

• Subject Index

The subject index consisting of entries naming specific materials, objects, and processes is arranged alphabetically. Document titles, informative phrases, or both specific to these entries are arranged alphabetically under the entries.

TOKAMAK ETF
Neutral Atom Beam Injection
Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields, 6:24582 (R:US)
Neutron Transport
Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields, 6:24582 (R:US)

• Contract Number Index

DOE technical literature is indexed using contract numbers under which the literature was produced. This index contains the contract number with corresponding abstract and report numbers.

W-7405-ENG-36	Los Alamos National Lab., NM (USA)	
	6:24582	LA–8830-MS

• Report Number Index

Technical report literature is also indexed using report numbers. This index includes information on where individual reports may be obtained. Patents and conference papers are indexed here as a matter of convenience. When a report is supplied under an Order Number, that number is included in the availability statement. An Order Number–Report Number Correlation is included for convenience.

LA–8830-MS	6:24582	NTIS, PC A05/MF A01. Order Number DE81023986, Distribution Category STD-20d

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SUBJECT CONTENTS (NUMERICAL LISTING)

Six-digit subject category numbers are used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's computerized bibliographic information system. The six-digit category numbers are utilized as if they were three pairs of two-digit numbers, the first two pairs being used to arrange the abstract content of *Energy Research Abstracts*. The following listing includes the totality of the 40 first-level and 293 second-level subject categories used. Because each issue of *ERA* announces only those documents becoming available during a semimonthly period, some subject categories may not be represented in every issue. The complete subject category scheme with scope definitions and limitations is available as DOE/TIC-4584-R5 from NTIS for $9.50.

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11400 (BEOP—23, pp 27-28) **Underground coal gasification with heat recuperation (job. 3.7.3, Technological University Delft).** Oct 1983. (In Dutch). NTIS (US Sales Only), PC A09/MF A01.

In Dutch National Research Programme on Coal. State of the art relating to the research done per July 1st, 1983.

Big scale tube experiments of water- instead of steam-injection in coal layers point out to a better overall efficiency of an underground gasification system. The cold water absorbs a part of the heat given off by the hot gas to the surrounding rocks and in that way is converted into steam. This cuts down the heat losses.

11401 (BMFT-FB-T—83-203) **Production of synthesis gas and hydrogen by pressurized coal dust gasification with oxygen and water by the Texaco-process.** Althoff, E.; Brunke, W.; Henckens, A.; Kolodzey, W.; Toelle, R.; Trondt, M.; Zagberg, U.; Gerhardus, U.; Heinen, H.; Koschnitzke, W. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Oct 1983. 112p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84750519.

Intention of the erection and operation of the demonstration plant in Holten, the most promissing coal-gasification process of the socalled "2sup(nd) Generation", the Texaco-Process, was the development up to the stage of industrial maturity. This target was reached during the project life time from November 1975 to April 1982. In the course of the 4-year testing period during 10.250 operation hours roughly 56.000 tons of coal were converted to 106 mio m^3 of synthesis gas. Twelve different coals, 6 of which were foreign, were gasified. The range of the ash content of the coals was between 6 and 28%, and the volatile matter between 16 and 42%. In this report informations are given about the steady state and dynamic plant behaviour, operational problems of components and their solutions as well as environmental impact. Finally some projects of industrial size (f.e. "Synthesegasanlage Ruhr") and possible different future applications of the Texaco-Gasification are introduced.

11402 (CONF-831239—4) **Transient simulation of coal gasification fuel plants.** Daniel, K.J.; Crapo, A.W.; Spradlin, L.W.; Dawes, M.H. (General Electric Co., Schenectady, NY (USA). Corporate Research and Development Center). 1983. Contract AC21-80ET14928. 2p. NTIS, PC A02/MF A01. Order Number DE84005706.

From Systems simulation symposium of fossil fuel conversion processes; Morgantown, WV, USA (6 Dec 1983).

Successful performance of control systems for future coal gasification fuel plants will be a key technical requirement. The objective of this modeling study is to provide a transient simulation model of a coal gasification fuel plant verified by experiments on the GE Process Evaluation Facility (PEF). Component models have been developed for a general fixed bed gasifier, several types of direct and indirect heat exchangers, valves, pipes, PID controllers, and a combined cycle power plant. In these models, quickly responding processes are assumed to be at steady state with respect to slower processes that are modeled dynamically. Each component model is capable of functioning as a transient simulation independently. Each is self-contained and includes its own integration routine and initialization routine. The initialization routine contains initial values of the integrated variables as well as all the physical dimensions of the component. This allows easy scaling of the component model. The structure within each component model is also user oriented and well documented so alterations can be performed quickly.

11403 (DOE/ET/10069—T32) **EDS Coal Liquefaction Process Development. Phase V. EDS Wyoming Coal Bottoms Recycle Study Design onsite design.** (Exxon Research and Engineering Co., Florham Park, NJ (USA)). Mar 1983. Contract FC05-77ET10069. 449p. (FE—2893-104). NTIS (US Sales Only), PC A19/MF A01. Order Number DE83013797.

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This report is an Interim Report for U.S. Department of Energy Cooperative Agreement No. DE-FC05-77ET10069 for EDS (Exxon Donor Solvent) Coal Liquefaction Process Development - Phase V. This report covers the Onsite Design for the EDS Wyoming Coal Bottoms Recycle Study Design. The EDS Wyoming Coal Bottoms Recycle Study Design utilizes a plant configuration in which the bulk of the net vacuum bottoms are used to provide plant H_2. The remaining solid vacuum bottoms are fired in conjunction with coal in a hybrid boiler to provide the necessary process heat to liquefaction. Other fuel needs in the plant are met by using C_2^- high Btu gas. Products from the plant include the remaining C_4^- high Btu gas, C_3 and C_4 LPG, hydrotreated naphtha and hydrotreated 350/800°F liquefaction distillate. The coal feed to liquefaction has been set at 25 kST/SD (dry). Additional (supplemental) coal will be used in the hybrid boiler.

11404 (DOE/ET/10069—T80) **EDS coal liquefaction process development: Phase V. EDS Wyoming Coal Bottoms recycle study design addendum.** (Exxon Research and Engineering Co., Florham Park, NJ (USA)). Dec 1983. Contract FC05-77ET10069. 303p. (FE—2893-123). NTIS (US Sales Only), PC A14/MF A01. Order Number DE84005843.

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This report documents the results of engineering activities which evaluated the design requirements for a commercial-scale EDS coal liquefaction plant located in Wyoming. The work modified, in addendum format, work previously completed regarding an EDS Wyoming Coal Bottoms Recycle Study Design. The modifications reflected results of recent engineering evaluations and learnings accrued from ECLP operations. As an addendum, this work builds on results of the previously reported study design work and this document should be used in combination with Interim Reports previously documented for the EDS Wyoming Coal Bottoms Recycle Study Design. These include, Onsite Design Basis (FE-2893-84), Offsite Design Basis (FE-2893-87), Onsite Design (FE-2893-104), Offsite Design (FE-2893-105), and Main Report (FE-2893-108). This report, abbreviated as the WYOBR Addendum, focuses its attentions on modifications made to the EDS Wyoming Coal Bottoms Recycle Study Design, referred to as the Base design. The EDS process directly converts coal to a range of clean hydrocarbon products. This is accomplished by contacting the coal with hydrogen in the presence of a hydrogenated solvent at approximately 840°F and 2500 psi. The WYOBR Addendum explores the technical and economic issues which might be faced if an EDS commercial-size plant were to be designed for Wyoming coal. It depicts the state of EDS technology in 1983, after approximately 15 years of development work which includes nearly two years of experience operating the large-scale pilot plant, ECLP. The WYOBR Addendum utilizes a plant configuration in which the majority of the net solidified vacuum bottoms are used to provide plant H_2.

11405 **(DOE/ET/10143—10-Rev.) H-Coal pilot plant 1980 turnaround report. Revision.** Searles, R.C. (Ashland Synthetic Fuels, Inc., KY (USA)). 3 Aug 1981. Contract AC05-76ET10143. 134p. NTIS MF A01. Order Number DE83012513.

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Since the start of H-Coal operations on March 11, 1980, the plant has operated for a total of 2949 hours. Of this total time on stream, 2572 hours were expended circulating oil and 377 hours with coal feed to the unit. Approximately 1148 tons of coal were processed during this period. The coal processed was Kentucky #11. On November 14, 1980, the H-Coal Pilot Plant was shut down for an overall turnaround maintenance program. During the turnaround period, all operating activities in the 100, 200, and 400 Areas were terminated to enable inspection and, as necessary, repair of all major equipment. Particular emphasis was placed on inspection of the coal liquefaction section (Area 200) which had not been inspected since the initial start-up in January 1980. Additionally, the Sour Water and Sour Gas Sections (Area 400) were thoroughly inspected due to previous evidence of cooling water corosion in several exchangers. During the turnaround, except for a very brief period, the Waste Oil Recovery Section (Area 600) continued to operate to recover start-up oil. In general, equipment inspection did not reveal any unexpected surprises and the turnaround maintenance work progressed very smoothly. By January 10, 1981, the turnaround maintenance work had been completed and plant start-up was initiated.

11406 **(DOE/ET/13800—4) Technical assessment of environmental control technologies for the Exxon Donor Solvent Commercial Plant.** Gray, D.; Neuworth, M.; Talib, A.; Tomlinson, G. (Mitre Corp., McLean, VA (USA). METREK Div.). Dec 1983. Contract AC01-80ET13800. 130p. NTIS, PC A07/MF A01. Order Number DE84004470.

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This report is a continuation of the analysis of the adequacy of proposed environmental control technologies in conceptual commercial designs of coal liquefaction plants. The first report assessed the adequacy of environmental controls for the Breckinridge Phase 0 and Revised Phase 0 designs for the H-Coal liquefaction process. This report is an analysis of environmental controls for the Exxon Donor Solvent (EDS) process for the processing of Wyoming coal in the bottoms recycle mode. The results of this analysis have shown that the proposed control technologies for wastewater treatability will be adequate. Disposal technologies for EDS solid effluents will also be adequate to handle the expected quantities and types of materials. Atmospheric emissions expected from the plant will still be considerable, even after application of controls. Recommendations to reduce the mass emission rates of these atmospheric emissions are suggested.

11407 **(DOE/ET/14880—17) Kinetics and mechanism of catalytic hydroprocessing of components of coal-derived liquids. Eighteenth quarterly report, August 16, 1983-November 15, 1983.** Gates, B.C.; Olson, J.H.; Schuit, G.C.A.; Stiles, A.B.; Petrakis, L. (Delaware Univ., Newark (USA). Dept. of Chemical Engineering; Gulf Research and Development Co., Pittsburgh, PA (USA)). 17 Jan 1984. Contract AC22-79ET14880. 31p. NTIS, PC A03/MF A01. Order Number DE84005491.

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A new method of structural analysis is applied to a group of hydroliquefied coal samples. The method uses elemental analysis and NMR data to estimate the concentrations of functional groups in the samples. The samples include oil and asphaltene fractions obtained in a series of hydroliquefaction experiments and a set of 9 fractions separated from a coal-derived oil. The structural characterization of these samples demonstrates that estimates of functional group concentrations can be used to provide detailed structural profiles of complex mixtures and to obtain limited information about reaction pathways. In general, functional group analysis is best suited for the structural analysis of complex liquids on which a large amount of data from a variety of sources is available. When applied, the method has several distinct advantages over other methods of structural characterization. It allows data from diverse sources such as NMR, IR and separation procedures to be incorporated into a single characterization; changes in structure are easily quantified; the types of structures present are easily visualized and the results could provide a starting point for kinetic modeling.

11408 **(DOE/FE/60181—21) Low-temperature liquefaction of North Dakota lignite.** Rindt, J.R.; Cisney, S.J. (North Dakota Univ., Grand Forks (USA)). Nov 1983. Contract FC21-83FE60181. 17p. (CONF-8311109—3). NTIS, PC A02/MF A01. Order Number DE84005436.

From Direct coal liquefaction contractor's review conference; Pittsburgh, PA, USA (16 Nov 1983).

Batch autoclave and tubing bomb tests were performed to evaluate low-rank coal liquefaction at temperatures of 320° to 400°C using CO feed gas. At 320°C, overall conversion, at 45 wt. % at temperatures of 360° to 400°C. Distillate yields of 14 to 16 wt. % at temperatures between 360° and 400°C were low when compared to yields of 20 to 25 wt. % at 460°C. However, the 70 wt. % yields of total liquid products at the lower temperatures were much higher than the 45 wt. % shown at elevated temperatures. Hydrocarbon gas yields were reduced from 6 wt. % at 460°C to 0.6 wt. % at 380°C. In addition to varying temperature, the reducing gas composition was varied from 100% CO to 100% hydrogen in 25% increments. Both conversion and yield of total liquid product were found to decrease ad the fraction of CO in the feed gas decreased.

11409 **(DOE/FE/60181—25) Structural properties affecting the settling of coarse crushed coal in gasifiers.** Hauserman, W.B. (North Dakota Univ., Grand Forks (USA). Energy Research Center). Jan 1984. Contract FC21-83FE60181. 28p. (CONF-840201—8). NTIS, PC A03/MF A01. Order Number DE84002665.

From ASME energy sources technology conference and exhibition; New Orleans, LA, USA (12 Feb 1984).

Coarsely crushed coals show wide variation in their ease and uniformity of settling through a fixed-bed gasifier. Their relative rate of thermal and mechanical attrition determine the limits of stable settling rates against upward flowing gases. Laboratory measurements of permeability and bulk shear strength of crushed lignite over a wide particle size range indicate gas/solid flow ratios over which stable settling rates are possible. The key factors in comparing coals as potential gasifier feeds are their thermal and mechanical friabilities and their caking tendency. For noncaking lignites, measurements of mechanical friabilities show a sharp increase with degree of pre-drying. While permeability decreases with decreasing particle size, bulk shear strength also decreases, though less sharply. For broad ranges of particle size, both parameters are dominated by the smaller particles present. Test procedures have been established to predict the shifts in size distribution during drying, pyrolysis, and settling, which in turn determine whether semi-stable bridges, bubbles, or channelling will occur. The slug flow assumption traditionally used in mathematical modelling of gasifier fuel bed behavior is not realistic. Laboratory data on friability, permeability, and shear strengt support failure scenarios for gasifier malfunctions near upper limits of throughput capacity and indicate a need for improved control over the fuel bed settling mechanisms.

11410 **(DOE/PC/60047—T1) Advanced research for the characterization of hydrogen donor solvents in two-stage liquefaction. Quarterly report, October 1, 1983-December 31, 1983.** Coghill, D.R.; Potts, J.D. (Cities Service Research and Development Co., Tulsa, OK (USA). Cities Service Technology Center). [nd]. Contract AC22-83PC60047. 18p. NTIS, PC A02/MF A01. Order Number DE84004752.

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The purpose of this research program is to develop an improved method for producing a highly effective solvent for the Integrated Two-Stage Liquefaction (ITSL) process and to study the characteristics of the solvent at a variety of process conditions. The ITSL process for conversion of coal to distillate liquids combines Short Contact Time (SCT) hydroliquefaction and expanded bed hydrogenation and cracking of the coal extract, either before or after deashing. The proposed improvement in the ITSL process is based on a modification of the expanded bed hydrotreating stage. The function of this process step is to hydrotreat and crack the heavy

SCT extract to distillate products, to remove sulfur and nitrogen, and to rehydrogenate the recycle hydrogen donor solvent. These operations are usually performed in a series of two or three catalytic expanded bed reactors using a common catalyst and similar process conditions. One of the primary reasons for the success of the ITSL process has been the separation of the dissolution and hydrotreating stages so that the process operating conditions for each stage may be optimized. It should be possible to further improve the ITSL process by also separating the hydrogenation and cracking operations in the second stage of the process. An extensive amount of research will be required to determine the effects of temperature, pressure, space velocity, catalyst, etc. in the above areas. Performance of these studies in an ITSL pilot plant would be expensive and time consuming. Cities Service Research and Development Company will perform these studies in small scale batch and continuous units specifically designed for this purpose.

11411 **(DOE/PC/60787—1) Composite-bed reactor for upgrading coal-derived liquids. Quarterly report Number 1, October 1-December 31, 1983.** Crynes, B.L.; Seapan, M. (Oklahoma State Univ., Stillwater (USA). School of Chemical Engineering). Jan 1984. Contract FG22-83PC60787. 8p. NTIS, PC A02/MF A01. Order Number DE84005400.

The reference catalyst that will be used throughout this study is Armak KF-153-S, a NiMo commercial catalyst. The reference liquid will be a 15 wt % mixture of SRC in a coal liquefaction process solvent. One experimental run was conducted to obtain reference data in a two zone reactor. The temperature of both zones was 400°C (752°F) with a pressure of 10.3 MPa (1500 psig). The liquid volume hourly space time across both zones was 1.9 h with a 20 to 80% space time distribution between the top and bottom zones, respectively. The duration of the experiment was 69 h. Results will be available in the next quarterly report. The emphasis in this research is directed toward hydrotreatment, including hydrocracking, of coal-derived liquids. The heteroatoms present in coal-derived liquids must be reduced; the liquids may require reduction in molecular weight and viscosity and small quantities of inorganic components may need to be reduced.

11412 **(DOE/PC/60798—1) Catalytic hydrotreatment studies with model compounds. Quarterly report, October 1, 1983-December 31, 1983.** Satterfield, C.N.; Smith, C.M. (Massachusetts Inst. of Tech., Cambridge (USA)). 1983. Contract FG22-83PC60798. 7p. NTIS, PC A02/MF A01. Order Number DE84005636.

The studies proposed under this grant are a continuation and extension of studies carried out under DOE Contract No. DeAC22-80PC30075, Crossed Reaction Networks in the Catalytic Hydrodenitrogenation of Synthetic Liquid Fuels. A laboratory scale trickle-bed reactor which was designed, constructed and operated under the previous contract was utilized. Before starting on a new series of experimental studies it appeared desirable to modify the equipment in a variety of ways to provide more precise operating control especially to ensure a safe operating environment. This quarter has been devoted to making these modifications. These included the installation of an intrinsically safe transducer circuit to sense pressure, improving control hydrogen gas supply to provide quick complete shutoff in the event of failure, installation of a device to detect loss of fume hood suction, and design of an electronic circuit to respond to system faults. Additional steps were taken to improve temperature control, and to allow the operator to adjust liquid flow rates without entering the hazardous area behind the barrier. Previously there was a 75 amp/208 volt circuit breaker panel behind the barrier; this has been disconnected and all electrical components are now located in a single enclosure remote from the hazardous area.

11413 **(NP—4770074) Environmental acceptability of coal gasification and liquefaction facilities in the Federal Republic of Germany.** (Gesamtverband des Deutschen Steinkohlenbergbaus, Essen (Germany, F.R.); Steinkohlenbergbauverein, Essen (Germany, F.R.)). Feb 1982. 123p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84770074.

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The publicaton discusses, in a systematic manner, all relevant plant components and materials and their environmental effects in order to get an overall view of the environmental impact of coal gasification and liquefaction (technology assessment). Subjects: The Lurgi process for SNG production; the Texaco process for synthesis gas and methanol production; coal liquefaction plants; emissions; air pollution, limiting values for immissions, acid rain, CO_2; siting problems, e.g. acceptability, planning licensing, citizens' participation.

11414 **(ORNL/TM—8651) Stability of short-contact-time coal liquefaction products.** Wham, R.M. (Oak Ridge National Lab., TN (USA)). Jan 1984. Contract W-7405-ENG-26. 70p. NTIS, PC A04/MF A01. Order Number DE84006246.

The primary purpose of this project was to study short-contact-time coal liquefaction in tubing-bomb microreactors using a recycle solvent from the Lummus Integrated Two-Stage Liquefaction Process and a Kentucky No. 9 coal (without the addition of gaseous hydrogen). Experiments were conducted to relate product stability to process parameters, including the time-temperatue history of the slurry during heatup to reaction temperature and the time which the slurry remained at temperature in the reactor. The most important result of this study was the significant increases in conversion to pyridine-soluble material obtained by modifying the portion of the slurry heating curve corresponding to the preheater portion of the process. As measured by pyridine-soluble components, the yields from reactions at 700°K (800°F) at 5-min residence time at reaction temperature increased from 71 wt % (dry mineral matter-free coal) to 89 wt % by introducing a 2.5-min delay at 589°K (600°F) during heatup. Other results indicated that conversion is significantly affected by the degree of mixing; retrograde reactions were observed for reaction times greater than 10 min and a temperature of 733°K (860°F). The Lummus solvent used in the study appears to contain a significant fraction of polycyclic aromatics containing two to five aromatic rings.

11415 **(ORNL/TM—8925) Program plan for development of slurry pumps for coal gasification system.** Lackey, M.E. (Oak Ridge National Lab., TN (USA)). Dec 1983. Contract W-7405-ENG-26. 53p. NTIS, PC A04/MF A01. Order Number DE84006096.

This effort was conducted to provide supporting data for a proposed Department of Energy program for the development of components for service in gasification systems. This report deals with slurry pump applications, and its scope includes a broad range of gasification systems including the generic models for entrained-flow, moving-bed, and fluidized-bed gasifiers. The major gasifier process areas that utilize slurry pumps are coal slurry preparation and feeding, ash quench and disposal, gas cleanup, and char utilization. The pressure rise requirements and solids-handling capability of identified slurry pump applications varied over the complete spectrum from a low-pressure rise with a low-solids content to a high-pressure rise with a high-solids content. A state-of-the-art industrial capabilities survey indicated that the gasification slurry pump requirement could be met by the use of either a centrifugal or a reciprocating pump. The centrifugal pumps would be employed for those applications not requiring a pressure rise in excess of 0.68 MPa (100 psi), and reciprocating pumps would be employed for the higher pressure rise requirements; however, based upon operating experience in the coal liquefaction and gasification programs, the expected continuous operating times for centrifugal slurry pumps in 3 months to 1 year, and reciprocating slurry pumps is 15 d to 6 months. These short continuous operating times indicate a current technology gap between the state-of-the-art pumps and those that will be acceptable for commercial gasification processes. An R & D program was developed to provide a fundamental understanding of the causes of the technology gaps. System designs required to eliminate these gaps would be verified by proof of concept testing. 27 references, 1 figure, 11 tables.

11416 **(ORNL/TM—9043) Upgrading coal-derived liquids by means other than hydrotreatment. I. Salmonella microbial mutagenicity.** Ho, C.H.; Jones, A.R.; Epler, J.L.; Guerin, M.R. (Oak Ridge National Lab., TN (USA)). Feb 1984. Contract W-7405-ENG-26. 29p. NTIS, PC A03/MF A01. Order Number DE84006245.

Studies by the Oak Ridge National Laboratory and at Pacific Northwest Laboratory on hydrogenated coal liquids have shown that hydrotreatment significantly reduces the toxicological properties of coal liquefaction products. However, the cost of hydrotreatment is significant. This report presents the initial results of studies designed to identify and evaluate promising non-hydrotreating processes for reducing the toxicological properties of coal liquids. In these studies to date, the biological evaluation has been limited to the Ames mutagenicity assay. Other bioassays including mouse dermal tumorigenicity and aquatic toxicity are in progress but have not yet been completed. Samples used in this study were two heavy fuel oils and one fuel oil blend obtained from the Catlettsburg, KY, H-Coal Pilot Plant. One of the heavy fuel oil samples was subjected to nine alternative processes which were designed to reduce or eliminate the microbial mutagenicity of the oil. Mutagenicity assays on the resulting products indicated that the first six treatments listed showed promise for removing mutagens. The fraction of the mass recovered after each of these treatments ranged from 70 to 85%. Five of the promising treatments identified in the exploratory study were applied to five H-coal liquid products. Each of the listed treatments (distillation, sulfuric acid treatment, deasphalting, pentane/furfural partition, and clay percolation) was found to significantly reduce the mutagenicity in the resulting product.

11417 **(PB—84-100130) Effects of selected inorganic coal-gasification constituents on aquatic life: an annotated bibliography.** Koch, L.M.; Young, R.C. (Tennessee Valley Authority, Muscle Shoals, AL (USA). Office of Natural Resources). Mar 1983. 40p. NTIS, PC A03/MF A01.

This review is concentrated on primary inorganic pollutants of concern which result in the aqueous discharges of high-pressure coal-gasification technologies. These pollutants include ammonia, cyanide (thiocyanates), sulfide, and boron. Ammonia toxicity was not reviewed since effective waste treatment technologies and discharge guidelines are available. The open literature concerning the effects of cyanide (thiocyanates), boron, and sulfide on aquatic life was reviewed using computer search techniques to obtain information from the Department of Energy RECON data base, the BIOSIS biological file in ORBIT data base, chemical abstracts, and the National Technical Information Service. It was concluded that there is a void in the literature concerning the toxicity of these parameters in high-pressure, coal-gasification wastewater matrices. The information abstracted is mainly concerned with laboratory studies with individual constitutents; however, some data provide insight to the effects of physical parameters such as temperature and physical stress.

11418 **(PB—84-103324) Simplex gasification demonstration in the Wellman-Galusha gasifier. Open file report 24 Sep 80-15 Jun 82.** (Dynecology, Inc., Harrison, NY (USA)). 30 Jun 1982. 122p. NTIS, PC A06/MF A01.

The objectives of this project were to produce at least 200 tons of Simplex briquets and to evaluate their performance as a fixed-bed, dry-bottom gasifier feed stock. To accomplish this, 240 tons of caking coal and shredded municipal refuse were compacted into Simplex briquets and gasified in a Wellman-Galusha producer at the Bureau of Mines in Minneapolis, MN. It was concluded that the briquets have good potential as a gasifier feed stock and that the briquets do not swell or cake even though they contain 67 wt pct of a highly caking eastern bituminous coal.

11419 **(PB—84-104637) Basic studies of new coal conversion catalysts. Annual report Jan-Dec 81.** Wise, H. (SRI International, Menlo Park, CA (USA)). Feb 1982. 36p. NTIS, PC A03/MF A01.

In the development of sulfur-tolerant, direct methanation catalysts, additional basic data have been generated that are needed for catalyst design and synthesis. Specifically, the studies have aided in establishing the relationship between catalyst structure, catalyst composition, and catalytic activity. X-ray photoelectron spectroscopy (XPS) has provided information on solid-state interactions. X-ray diffraction (XRD) studies have demonstrated the morphological changes that the catalysts undergo during direct methanation and the temperature regime in which changes in surface area occur. These results have been reflected in kinetic studies over a range of temperatures. The methanation rates obtained at low total pressure (15 psig) were found to scale to higher total pressures (200 psig), indicative of the same mechanism for direct methanation over the entire pressure range. The role of the reverse water-gas shift reaction in the methanation process was examined as a function of space velocity, pressure, and reaction temperature. The results obtained from the kinetic measurements are important to understanding the reaction mechanism of direct methanation.

11420 **(PB—84-104876) Evaluation of coal conversion catalysts. Annual report Jan-Dec 81.** Lee, A.L. (Institute of Gas Technology, Chicago, IL (USA)). Dec 1981. 23p. NTIS, PC A02/MF A01.

Design data for the direct methanation process using raw gases such as would be produced by a Slagging Lurgi-type gasifier and by a Westinghouse-type gasifier were obtained.

11421 **(UCRL—50026-83-3) LLNL Underground Coal Gasification Project. Quarterly progress report, July-September 1983.** Stephens, D.R.; Clements, W. (eds.). (Lawrence Livermore National Lab., CA (USA)). 6 Dec 1983. Contract W-7405-ENG-48. 28p. NTIS, PC A03/MF A01. Order Number DE84006274.

Our CAVSM computer code was developed to model burn cavity growth in an underground coal gasification (UCG) system. A key feature of this model as compared with previous ones we have used is its inclusion of provisions for taking account of the motion of solid materials - for example, the falling away of chunks of coal that break off from the roof and walls of the gasification cavity. We have already incorporated in the code much of the cavity growth behavior observed in our large block (LBK) field experiments done near Centralia, Washington, in 1981-1982, and we are continuing to refine it and extend its capabilities. A basic improvement to CAVSM that we recently embarked on is to develop analytic expressions as input to the calculations of cavity growth processes. These will replace the previously used input, which consisted of prescribed values based on results from earlier UCG experiments. Thus far we have derived equations for the steam/char reaction near the surface of coal exposed to heat from the outside, and for the resultant drying of the coal under the surface, all based on an assumed constant surface temperature. Our next step will be to develop equations for a time-varying surface temperature. With such analytic expressions as input, we expect the code to be more versatile in modeling UCG situations for which previous experimental data is not available. As a further development of the CAVSM code, we have extended the treatment of solid rubble material falling into the cavity to include inert material as well as fallen chunks of coal. This means that the code can now treat overburden material - wet roof rock, for example - that may fall into the cavity when the burn reaches the top of the coal seam.

11422 **TVA quantifies value of burning physically cleaned coal on plant operating, maintenance, FGD costs.** *Electric Light and Power;* **61**: No. 12, 19(Dec 1983).

Utilities can save money by cleaning coal before using, according to a Tennessee Valley Authority report that quantifies the costs of washing coal and the benefits in fewer boiler outages and lower maintenance and flue-gas desulfurization costs. A coal-cleaning model used by TVA to develop the cost-benefit comparisons also showed that a combination of coal cleaning and flue-gas desulfurization is cheaper than tail-end flue-gas cleaning, although coal cleaning can increase particulate collection costs in some cases. 3 tables. (DCK)

11423 **Health and environmental assessment of low Btu gasification.** Van Hoesen, S.D.; Cowser, K.E.; Cushman, R.M.; Dreibelbis, W.G.; Griest, W.H.; Klein, J.A.; Larmer, F.W.; Meyer, H.R.; Strand, R.H. (Oak Ridge National Lab., TN). pp 513-514 of 5th Miami international conference on alternative energy sources. Vezirogla, T.N. (ed.). Coral Gables, FL; Univ. of Miami (1983). (CONF-821213—).

From 5. international conference on alternative energy source; Miami Beach, FL, USA (13 Dec 1982).

11424 **Changes in hydrogen utilization with temperature during direct coal liquefaction.** Finseth, D.H.; Bockrath, B.C.; Cillo, D.L.; Illig, E.G.; Sprecher, R.F., Retcofsky, H.L.; Lett, R.G. (Pittsburgh Energy Tech. Center, PA). *Preprints of Papers - American Chemical Society, Division of Fuel Chemistry;* **28**: No. 5, 17-25(1983). (CONF-830814—Vol.4).

From 186. national meeting of the American Chemical Society; Washington, DC, USA (28 Aug 1983).

A reliable means of monitoring the major pathways of hydrogen utilization, in contrast to only measuring net hydrogen consumption, would be very useful for process optimization. The goal of this work was to develop an analytical approach for quantitatively distinguishing hydrogen consumed in hydrogenation from that utilized to stabilize thermolysis fragments. The approach outlined yields a rather detailed description of the net utilization of hydrogen during direct liquefaction, partitioning it into contributions from gas generation, heteroatom removal, hydrogenation, and matrix breakdown. Preliminary results indicate that internal hydrogen reorganization, with little consumption, predominates at low temperatures, with hydrogenation being compensated for by the hydrogen liberated in condensations. As the temperature is increased, bond cleavage reactions and aromatization reactions appear to become more important, and the net hydrogen consumption increases. (3 tables 1 figs., 11 refs.)

11425 **Effects of heavy recycle solvent components on direct coal liquefaction.** Longanbach, J.R. (Battelle Columbus Lab., OH). *Preprints of Papers - American Chemical Society, Division of Fuel Chemistry;* **28**: No. 5, 70-76(1983). (CONF-830814—Vol.4).

From 186. national meeting of the American Chemical Society; Washington, DC, USA (28 Aug 1983).

The quality of the recycle solvent is critcally important in all direct coal liquefaction processes. The fact that overall solvent quality can be greatly improved by adding some of the lighter nondistillable products to the solvent is one of the most important discoveries in direct coal liquefaction research in recent years. Many recent studies have focused on the role of solvent in direct liquefaction. One of the problems encountered in all of these studies has been that when actual process derived solvents are used, they are so complex that the results are hard to assign unambiguously to particular chemical properties of the solvent, while the use of model compounds have simply not included materials of sufficiently high molecular weight to adequatley represent the heavier species in true recycle solvents. The purpose of this work is to further study the liquefaction chemistry of the heavier materials in a process derived liquefaction solvent. Solvents obtained from near equilibrium operation of the Lummus ITSL Process are being used because others have shown that this solvent is less complex than solvents from other processes. (4 tables, 1 figure, 8 refs.)

11426 **Ortho-allybenzyl radical: a sensitive procedure for the assessment of hydrogen donor solvent reactivity.** Franz, J.A.; Barrows, R.D.; Camaioni, D.M. (Pacific Northwest Lab., Richland, WA). *Preprints of Papers - American Chemical Society, Division of Fuel Chemistry;* **28**: No. 5, 77-80(1983). (CONF-830814—Vol.4).

From 186. national meeting of the American Chemical Society; Washington, DC, USA (28 Aug 1983).

The thermal conversion of coal involves the decomposition of interconnected hydroaromatic structures into resonance stabilized benzylic radical fragments. Capping of these radicals with hydrogen from a donor solvent leads to the formation in high yields of lower molecular weight soluble and volatile products. In the absence of a donor solvent, the radicals abstract hydrogen from alkyl coal structures and depending on the supply of donatable hydrogen within the coal, conversion yields may be greatly affected. In view of the great variety of radicals which must form during coal liquefaction and the many possible competing reactions which lead to products, the ability of a donor solvent to transfer hydrogen to coal radicals is undoubtedly of great importance. A procedure has been developed for the quantitative determination of hydrogen donor strengths toward benzyl radical. The method competes the rearrangement of o-allylbenzyl radical against hydrogen transfer to the radical from a donor solvent. At this time, the method provides relative and estimated absolute rates of hydrogen atom transfer. Experiments are in progress which are designed to convert these relative rates to absolute rates with a high degree of accuracy and precision. (1 table, 19 refs.)

11427 **Radical initiation and phenol inhibition in the thermal, free radical decomposition of 1,3-diphenylpropane, dibenzylether and phenethylphenylether, coal liquefaction model studies.** Gilbert, K.E. (Indiana Univ., Bloomington). *Preprints of Papers - American Chemical Society, Division of Fuel Chemistry;* **28**: No. 5, 144-149(1983). (CONF-830814—Vol.4).

From 186. national meeting of the American Chemical Society; Washington, DC, USA (28 Aug 1983).

Current thought on the structure of coal and the chemistry of coal liquefaction suggests that coal consists of large polycyclic clusters joined by short aliphatic links and that liquefaction reactions occur at these links. Much research has gone into the two atom links. In addition to the cleavage-abstraction reactions available to the two atom links, the three atom links may also react by radical chain reactions. These radical chain reactions can occur over a much wider temperature range than the cleavage-abstraction reactions and thus offer the possibility of a low temperature liquefaction process. Previous work has shown that the title compounds decompose by free radical chain reactions as neat liquids or as solutions in hydrogen donating solvents in the temperature range of 300 to 400°C. Initiation of the radical chain process by benzylphenylether at 350° was demonstrated, but inhibition of the chain reactions by standard inhibitors, such as hindered phenols, was not studied. This paper reports on the effect of hindered phenols on the decomposition of the title compounds at 350°, the development of methods for initiating these reactions at temperatures as low as 138°, the effect of hindered phenols on these reactions at lower temperatures, and on the kinetic and thermodynamic barriers to these radical chain reactions. (3 tables, 2 figures, 5 refs.)

11428 **Molecule-induced homolysis in coal chemistry: radical intermediates in the thermal decomposition of 1,2-dihydronaphthalene.** Franz, J.A. (Pacific Northwest Lab., Richland, WA); Camaioni, D.M.; Beishline, R.R.; Dalling D. *Preprints of Papers - American Chemical Society, Division of Fuel Chemistry;* **28**: No. 5, 150-154(1983). (CONF-830814—Vol.4).

From 186. national meeting of the American Chemical Society; Washington, DC, USA (28 Aug 1983).

Molecule-induced homolysis (MIH), the process by which two closed-shell molecules react to produce free radicals, has been recognized as an important contributing pathway to radical initiation during coal dissolution. The production of organic radicals by MIH and other pathways can lead in stepwise fashion to the production of highly reactive radicals to a significant degree at temperatures >400°C. This paper summarizes results which show that the decomposition of 2,2-dihydronaphthalene (DHN) involves both 1-hydronaphthyl (1HN) and 2-hydronaphthyl (2HN) radicals as well as 1-tetralyl radical and that the production of 1HN and 2HN leads to the scission of hydrogen atom and its participation in subsequent hydrocracking reactions. (1 table, 1 figure, 6 refs.)

11429 **In-situ study under direct coal liquefaction conditions of the surface interaction between iron sulfides and selected number of model compounds.** Montano, P.A.; Bommannavar, A.S.; Lee, Y.C. (West Virginia Univ., Morgantown). *Preprints of Papers - American Chemical Society, Division of Fuel Chemistry;* **28**: No. 5, 169-182(1983). (CONF-830814—Vol.4).

From 186. national meeting of the American Chemical Society; Washington, DC, USA (28 Aug 1983).

The importance of iron sulfides in direct coal liquefaction has been noted by several investigators; an increase in coal conversion and quality of the products has been observed in their studies. In order to gain a better understanding of the role of iron sulfides in coal liquefaction this study investigated in-situ the interaction of FeS_2, and Fe_7S_8 with a series of model compounds. In the experiments 10% catalysts by weight were added to the model compounds. The model compounds studied were dibenzothiophene, pyrene, phenanthrene, 1,4-naphthoquinone, phenothiazine, and quinoline. The experiments were performed in nitrogen and hydrogen

atmospheres. Evidence was found of interaction between the pyrrhotites and some of the model compounds. The formation of intermediate iron oxides in 1,4-naphthoquinone indicates a strong interaction between the iron on the pyrrhotite surface and oxygen. The surface composition of pyrrhotite at 450°C was also studied in a UHV reaction chamber and the interaction with H_2, O_2 and CO was investigated using electron energy loss spectroscopy. (3 tables, 11 figures, 16 refs.)

11430 **Characterization of short contact time dissolution products from a series of vitrinite-rich coals.** Winans, R.E.; King, H.H.; McBeth, R.L.; Botto, R.B. (Argonne National Lab., IL). *Preprints of Papers - American Chemical Society, Division of Fuel Chemistry;* **28**: No. 5, 8-16(1983). (CONF-830814—Vol.4).

From 186. national meeting of the American Chemical Society; Washington, DC, USA (28 Aug 1983).

The objective of this study is to identify the transformations that occur in coal organic structural units during liquefaction. To ensure that mainly primary reactions are being observed, the study has focused on short contact time dissolution in donor solvent media. The relationship between the compositional parameters of the coals and both their reactivity and product chemical characteristics have been examined. Since the benzene insoluble, pyridine soluble fraction, often called asphaltols or preasphaltenes, is a key intermediate in the initial stage of coal liquefaction, the solubility in hexane, benzene/ethanol, and pyridine was correlated with compositional parameters. It has been shown that mineral matter exerts a beneficial and possibly unpredictable effect on the coal dissolution. To examine the effects of the demineralization and grinding, a series of 21 of the treated unseparated coals were studied. The original raw coals were obtained from the Penn State Coal Sample Bank. It was observed using multivariate analysis that product solubility, which was used to determine conversion, can be predicted from linear combinations of carbon, hydrogen, density and exinite content. Another set of coals which had not been demineralized, and which was obtained from the Exxon Coal Library was also studied. These samples are essentially premium coals chich have been protected form oxidation and are homogeneous. (3 tables, 6 figs., 13 refs.)

11431 **Characterization of artifacts produced from tetralin donor vehicle under coal liquefaction conditions.** Sundaram, M.S.; Given, P.H. (Pennsylvania State Univ., University Park). *Preprints of Papers - American Chemical Society, Division of Fuel Chemistry;* **28**: No. 5, 26-39(1983). (CONF-830814—Vol.4).

From 186. national meeting of the American Chemical Society; Washington, DC, USA (28 Aug 1983).

The hexane-soluble oil fraction of the heavy liquids produced from the liquefaction of coal using tetralin donor vehicle was fractionated by high pressure liquid chromatography. Three fractions were obtained: saturates, aromatics and polars. Each fraction was individually characterized via capillary column gas chromatography/mass spectrometry. Several binaphthyls and binaphthyl derivatives, produced from the donor solvent tetralin under coal liquefaction conditions, were identified in the aromatic fraction. These artifacts make up an important fraction of the whole aromatic fraction. There is a fairly clear tendency for the concentration of binaphthyls and derivatives to decrease with increasing rank of coal. A stepwise multiple regressional analysis shows that the clay minerals and pyrite present in coal independently catalyze one or more of the types of artifact formation. (4 tables, 3 figs., 17 refs.)

11432 **Fate of selected 1-, 2-, and 3-ring compounds during recycle coal liquefaction operation.** Cronauer, D.C.; McNeil, R.I.; Danner, D.A.; Wieland, J.H.; Abichandani, J.S. (Univ. of Pittsburgh, PA). *Preprints of Papers - American Chemical Society, Division of Fuel Chemistry;* **28**: No. 5, 40-47(1983). (CONF-830814—Vol.4).

From 186. national meeting of the American Chemical Society; Washington, DC, USA (28 Aug 1983).

To observe the adduction, isomerization, and cracking of labeled solvent species, a series of coal liquefaction runs was undertaken using a bench-scale unit capable of continuous recycle operation. These experiments were made with ^{13}C-labeled solvents including octahydrophenanthrene, phenanthrene, methylphenanthrene, dimethyltetralin, and mesitylene. This work served as an extension of previously reported laboratory-scale experiments using similar labeled model liquefaction solvents.

11433 **Recovery of alkali metal constituents from catalytic coal conversion residues.** Soung, W.Y. US Patent Application 6-447,350. [nd]. 22p. Contract AC01-78ET13005.

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In a coal gasification operation (32) or similar conversion process carried out in the presence of an alkali metal-containing catalyst wherein particles containing alkali metal residues are produced, alkali metal constituents are recovered from the particles by contacting them with water or an aqueous solution to remove water-soluble alkali metal constituents and produce an aqueous solution enriched in said constituents. The aqueous solution thus produced is then contacted with carbon dioxide to precipitate silicon constituents, the pH of the resultant solution is increased, preferably to a value in the range between about 12.5 and about 15.0, and the solution of increased pH is evaporated to increase the alkali metal concentration. The concentrated aqueous solution is then recycled to the conversion process where the alkali metal constituents serve as at least a portion of the alkali metal constituents which comprise the alkali metal-containing catalyst.

11434 **Air-flow regulation system for a coal gasifier.** Fasching, G.E. US Patent Application 6-445,641. [nd]. 12p.

An improved air-flow regulator for a fixed-bed coal gasifier is provided which allows close air-flow regulation from a compressor source even though the pressure variations are too rapid for a single primary control loop to respond. The improved system includes a primary controller to control a valve in the main (large) air supply line to regulate large slow changes in flow. A secondary controller is used to control a smaller, faster acting valve in a secondary (small) air supply line parallel to the main line valve to regulate rapid cyclic deviations in air flow. A low-pass filter with a time constant of from 20 to 50 seconds couples the output of the secondary controller to the input of the primary controller so that the primary controller only responds to slow changes in the air-flow rate, the faster, cyclic deviations in flow rate sensed and corrected by the secondary controller loop do not reach the primary controller due to the high frequency rejection provided by the filter. This control arrangement provides at least a factor of 5 improvement in air-flow regulation for a coal gasifier in which air is supplied by a reciprocating compressor through a surge tank. 2 figures.

11435 **Ash bed level control system for a fixed-bed coal gasifier.** Fasching, G.E.; Rotunda, J.R. US Patent Application 6-473,308. [nd]. 18p.

An ash level control system is provided which incorporates an ash level meter to automatically control the ash bed level of a coal gasifier at a selected level. The ash level signal from the ash level meter is updated during each cycle that a bed stirrer travels up and down through the extent of the ash bed level. The ash level signal is derived from temperature measurements made by thermocouples carried by the stirrer as it passes through the ash bed and into the fire zone immediately above the ash bed. The level signal is compared with selected threshold level signal to determine if the ash level is above or below the selected level once each stirrer cycle. A first counter is either incremented or decremented accordingly. The registered count of the first counter is preset in a down counter once each cycle and the preset count is counted down at a selected clock rate. A grate drive is activated to rotate a grate assembly supporting the ash bed for a period equal to the count down period to maintain the selected ash bed level. In order to avoid grate binding, the controller provides a short base operating duration time each stirrer cycle. If the as bed level drops below a selected low level or exceeds a selected high level, means are provided to notify the operator. 2 figures.

11436 **Erosion resistant elbow for solids conveyance.** US Patent Application 6-483,404. [nd]. 13p. Contract AC21-80ET14752.

An elvow and process for fabrication for use in particulate material conveying comprising a curved outer pipe, a curved inner

pipe having the same radius of curvature as the outer pipe, concentric with and internal to the outer pipe, comprising an outer layer comprised of a first material and an inner layer comprised of a second material wherein said first material is characterized by high erosion resistance when impinged by particulate material and wherein said second material is characterized by high tensile strength and flexibility, and an inner pipe supporting means for providing support to said inner pipe, disposed between said inner pipe and said outer pipe. 4 figures.

0105 By-products

REFER ALSO TO CITATION(S) 11433, 11534

0106 Properties

REFER ALSO TO CITATION(S) 11459, 11461, 11469, 12343, 12399

11437 (BEOP—23, pp 18-19) **Technological University Delft (job 3.1.1.): research on coal and coal products by means of magnetic resonance.** Oct 1983. (In Dutch). NTIS (US Sales Only), PC A09/MF A01.

In Dutch National Research Programme on Coal. State of the art relating to the research done per July 1st, 1983.

By combining dynamic nuclear polarization, for which an unique probe was developed, and cross polarization in NMR techniques, such a signal amplification was reached that 13C-spectra of coal could be obtained within a few minutes. This opens the possibility for studying coal conversion processes by spectral shifts even in situ. The spectral shifts particularly relate to the ratio of aromatics/aliphatics.

11438 (DOE/PC/30013—T3) **Data base for the analysis of compositional charateristics of coal seams and macerals. Final report, Part 6. Petrography and depositional environment of the Herrin (No.6) seam in central, eastern and northwestern Illinois.** Russell, S.J. (Pennsylvania State Univ., University Park (USA). Coal Research Section). Jan 1984. Contract AC22-80PC30013. 215p. NTIS, PC A10/MF A01. Order Number DE84005495.

The objectives of this study were to characterize and compare the petrography of the Herrin (No. 6) seam in the sampling areas and to relate the petrography to the sedimentology, conditions during peat deposition and to the paleobotany of the seam. Sixteen column samples of the Herrin (no. 6) seam from 9 mines in central, eastern and northwestern Illinois were described megascopically in terms of the lithotypes vitrain, clarain, duroclarain, clarodurain, durain and fusain. Ten of the columns were also analyzed petrographically. The columns were divided into subsections based on the maceral content. Two characteristic seam profiles were identified. Samples from northwestern Illinois and from central Illinois west of the peat-contemporaneous Walshville channel have a profile consisting of alternating subsections of relatively inertinite-rich lower subsections and inertinite-poor upper subsections. All coal columns studied terminate upward in n inertinite-poor subsection. The coal petrography is believed to have been controlled by fluctuations in the water table during peat deposition which were caused either by variation in rainfall or by changes in sea level. Prior to the marine transgression which ended peat accumulation, the water table in the swamp rose everywhere within the study area. The results of this work compare favorably with paleobotanical studies of the Herrin (No. 6) seam. 151 references, 41 figures, 13 tables.

11439 (DOE/PC/30223—10) **Petrographic characterization of Kentucky coals. Final report. Part II. Depositional settings of the coal bearing, upper Tradewater Formation in western Kentucky with emphasis on the Mannington (No. 4) coal zone.** Baynard, D.N.; Hower, J.C. (Kentucky Univ., Lexington (USA)). 1983. Contract FG22-80PC30223. 107p. NTIS, PC A06/MF A01. Order Number DE84004897.

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Depositional settings were determined in the coal bearing, Middle Pennsylvanian, upper Tradewater Formation in western Kentucky with emphasis on the Mannington (No. 4) coal zone. The coals have been analyzed for maceral contents, lithotypes, dry sulfur/ash percentages, vitrinite reflectance values, pyrite/marcasite contents, and associated lithologies at different vertical and lateral scales. This study concludes that: (1) the thin coarsening - or fining upward sequences, under the Mannington (No. 4) coal zone are possibly shallow bayfill and channel-fill deposits that provided an environment that has slight differences in topography, (2) rapid vertical and lateral change in total vitrinite, dry sulfur/ash percentages and lithotypes at different scales in the Mannington (No. 4) coal zone are indicative of wideranging Eh and pH values and possibly result from slight changes in paleotopography, and (3) the Davis (No. 6) coal was deposited after a period of thick coarsening - or fining upward sequences, possibly providing a relatively flat-stable surface for peat development. The consistent total vitrinite, dry sulfur/ash values, and thickness trends indicate a more restricted environment (pH and Eh) in the Davis (No. 6) swamp. 41 references, 25 figures, 3 tables.

11440 (PB—84-119601) **Determination of trace elements in coal by atomic-absorption spectroscopy.** Kellerman, S.P.; Haines, J.; Robert, R.V.D. (Council for Mineral Technology, Randburg (South Africa)). 15 Oct 1983. 21p. (MINTEK-M—121). NTIS, PC E03/MF E01.

Methods based on atomic-absorption spectrophotometry, and involving various techniques for dissolution and measurement of the sample, have been developed for the determination of trace elements in coal. Non-volatile elements are determined by flame atomic absorption, and vanadium by electrothermal atomization of a solution, after ashing of the sample and dissolution of the residue with acid. Arsenic, selenium, bismuth, and tellurium are determined by hydride generation on a separate portion of the sample that has been ashed in the presence of sodium carbonate and fused with sodium peroxide. The laboratory methods are detailed in the appendices.

11441 **Correlation of coal quality to coal liquefaction.** Hoover, D.S. (International Coal Refining Co., Allentown, PA). *Preprints of Papers - American Chemical Society, Division of Fuel Chemistry;* **28**: No. 5, 48-57(1983). (CONF-830814—Vol.4).

From 186. national meeting of the American Chemical Society; Washington, DC, USA (28 Aug 1983).

Although it is clear that variations in feed coal properties can affect plant operations and yields, few quantitative relationshiips have been developed. The difficulty in understanding the importance of coal characteristics is in part related to the complex nature of coal, and problems in the selection, characterization and testing of representative feedstock samples. The driving force for developing this understanding is directly related to the selection and procurement of the essential raw material for liquefaction processing. A scientifically based understanding of how to select coal sources from within a mining region and how to compensate for variations from an individual mine will improve the operability economics of any direct liquefaction plant. This study has investigated the degree to which coal properties change within a supply region and how these variations impact on yields and economics of an SRC-I type process. Statistical data analysis has isolated critical coal properties influencing liquefaction reactivity and quantitative prediction equations have been developed. (3 tables, 9 figs., 16 refs.)

0108 Waste Management

REFER ALSO TO CITATION(S) 11423, 11433, 11469, 12443, 12862

11442 (PB—83-252049) **Practices for protecting and enhancing fish and wildlife on coal surface-mined land in the southcentral U.S. Handbook.** Ambrose, R.E.; Hinkle, C.R.; Wenzel, C.R. (Science Applications, Inc., Oak Ridge, TN (USA)). Mar 1983. 244p. NTIS, PC A11/MF A01.

This handbook contains information on the best current practices to minimize disturbances and adverse impacts of surface mining on fish and wildlife resources. Current state and federal legislation was reviewed to determine those practices which were most compatible with the best technology currently available, fish and wildlife plans, and reclamation plans for the Southcentral

region of the U.S. The information presented includes risks, limitations, approximate costs, and maintenance and management requirements of each practice. Plans for the restoration of specific habitats, according to the best current practices, are also included.

11443 **(PB—83-253401) Development of a procedure for land use potential evaluation for surface-mined land. Open file report (final), September 1979-December 1982.** Ramani, R.V.; Sweigard, R.J. (Pennsylvania State Univ., University Park (USA)). 31 Jan 1983. 119p. NTIS, PC A06/MF A01.

Productive and beneficial use of reclaimed surface-mined land is a concern of industry, government, and the general public. An investigation was conducted of current mined-land planning practices to aid in the development of a procedure for evaluating postmining land use potentials. This investigation considered both the industry and public approach to mined-land planning. It included a detailed review of the impact of regulation, factors that determine land use, and current site planning methods employed by the mining industry. The methods of this investigation included three in-depth case studies of surface mines in the Eastern, Central, and Western United States. A site planning process was developed and applied to the surface mine case studies to evaluate the economic, environmental, and social impacts of postmining land use alternatives.

11444 **(PB—83-259713) Preliminary environmental assessment on formcoke cokemaking process. Final report, February-June 1980.** Coy, D.W.; Allen, C.C.; Carpenter, B.H. (Research Triangle Inst., Research Triangle Park, NC (USA)). Aug 1983. 70p. NTIS, PC A04/MF A01.

The report gives results of a preliminary environmental evaluation and assessment of formcoking. The work is based on readily available literature sources, a plant visit, formcoke plant proposal and feasibility study data, and discussions with engineers and operators involved with formcoking. Material balances, calculations, and engineering judgement were used to convert existing data and information into a form that can be used to compare environmental discharges between formcoking and conventional by-product coking. Comparison results are presented. The lack of environmental data on formcoking is noted.

11445 **Treatment of solvent-refined coal wastewater.** Drummond, C.J.; Noceti, R.P.; Walters, J.G. (Pittsburgh Energy Technology Center, PA). *Environmental Progress;* 1: No. 1, 73-78(Feb 1982).

The wastewater selected for study was the SRC-I recycle process water stream after oil-water separation. This stream contains water formed in the coal-liqufaction reactor, water added to the process to prevent ammonium-salt-deposition, and moisture included in the feed coal. The water was condensed concomitant along with the product and thus was in intimate contact with the product steam at elevated temperatures. Water-soluble components present in the liquid product are in this stream. This wastewater is considered to be the most representative sample available of recycle process water to be formed in large-scale SRC-I facilities. This investigation has demonstrated that a combination of dissolved-gas stripping, biochemical oxidation, and activated-carbon adsorption is effective in the treatment of SRC-I process recycle water. 17 references, 3 figures, 5 tables. (JMT)

0109 Environmental Aspects

REFER ALSO TO CITATION(S) 11423, 11444

11446 **(DOE/EA—0196) Environmental assessment: conversion to coal Schiller Generating Station Units 4, 5, and 6, Portsmouth, Rockingham County, New Hampshire.** (USDOE Economic Regulatory Administration, Washington, DC. Office of Fuels Programs). Nov 1983. 136p. NTIS, PC A07/MF A01. Order Number DE84005456.

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The proposed action, DOE finalization of the prohibition orders, will require the utility to discontinue the use of fuel oil at the Schiller Station in Units 4, 5, and 6, and to utilize coal or another alternative fuel as a primary energy source. The proposed conversion is expected to accomplish the desired objectives of reducing the use of petroleum while complying with existing legislation for environmental protection. The utility has prepared a plan to convert the three units to the burning of a relatively low sulfur coal brought in by ocean transport. Coal and ash handling and water treatment facilities will be upgraded as part of the conversion, and new particulate control equipment will be installed. Availability of coal with a low sulfur content, access to adequate landfill disposal space, and cost of conversion make the proposal fuel source preferable. Major issues of concern related to the conversion are air quality and the disposal of solid wastes. Impacts on water resources, ecology, community resources, and noise are expected to be minimal. The remainder of this section summarizes the conversion plan and its environmental effects. Additional detail on the proposed conversion is presented in Chapter 2.0, the existing environment is described in Chapter 3.0, and detailed environmental effects are presented in Chapter 4.0. 40 references, 14 figures, 17 tables.

11447 **(DOE/ET/13053—T1) Technical Support Services to the Division of Coal Conversion. Annual report for the period June 1976-December 1977.** (Radian Corp., McLean, VA (USA)). [nd]. Contract AC01-76ET13053. 11p. NTIS, PC A02/MF A01. Order Number DE84005729.

This document represents the first annual report on Contract No. EX-76-C-01-2314, Technical Support Services to the Division of Coal Conversion. The report provides brief technical summaries of contract activities. Radian has provided environmental technical support services to ERDA, and now to DOE, in a variety of areas supporting the fossil fuel demonstration programs. Also, Radian has provided DOE with quick reviews of environmental documents, technology transfer requests, and/or quick studies to provide timely technical input to a DOE decision-making process. Eleven task orders are given by title and described briefly; four final report titles are listed.

11448 **(DOE/ET/13053—T2) Technical Support Services to the Division of Fossil Fuels Processing. Annual report for 1978.** (Radian Corp., McLean, VA (USA)). [nd]. Contract AC01-76ET13053. 11p. NTIS, PC A02/MF A01. Order Number DE84005731.

This document represents the second annual report on Contract No. EX-76-C-01-2314, Technical Support Services to the Division of Fossil Fuels Processing. The report provides brief technical summaries of contract activities. Radian has provided environmental technical support services to ERDA, and now to DOE, in a variety of areas supporting the fossil fuel demonstration programs. Also, Radian has provided DOE with quick reviews of environmental documents, technology transfer requests, and/or quick studies to provide timely technical input to a DOE decision-making process. Task orders are listed by title and described briefly; titles of seven major reports delivered during this period are listed.

11449 **(DOE/ET/13053—T3) Technical Support Services to the Division of Fossil Fuels Processing. Annual report for 1979.** (Radian Corp., McLean, VA (USA)). [nd]. Contract AC01-76ET13053. 10p. NTIS, PC A02/MF A01. Order Number DE84005726.

This document represents the annual report for 1979 on Contract No. EX-76-C-01-2314, Technical Support Services to the Division of Fossil Fuels Processing. The report provides brief technical summaries of contract activities. Radian has provided environmental technical support services to ERDA, and now to DOE, in a variety of areas supporting the fossil fuel demonstration programs. Also, Radian has provided DOE with quick reviews of environmental documents, technology transfer requests, and/or quick studies to provide timely technical input to a DOE decision-making process. Task orders are described briefly and titles of these final reports are listed.

11450 **(DOE/ET/13053—T4) Technical Support Services to the Office of Major Project Management. Final report.** (Radian Corp., McLean, VA (USA)). [nd]. Contract AC01-76ET13053. 19p. NTIS, PC A02/MF A01. Order Number DE84005732.

This document represents the final report on Contract No. DE-AC01-76ET13053, Technical Support Services to the Office of Major Project Management. The report provides brief technical summaries of contract activities. The purpose was for Radian Corporation to provide the Energy Research and Development Administration (ERDA) with environmental technical support for the development of fossil fuel demonstration plants. Since that time, Radian has provided environmental technical support services to ERDA, and now to DOE, in a variety of areas supporting the fossil fuel demonstration programs. Also Radian provided DOE with quick reviews of environmental documents, technology transfer requests, and/or quick studies to provide timely technical input to a DOE decision-making process. Because some task orders were expressly designed to provide quick-response, as-needed assistance, they did not generate any major reports. Task orders are listed and brief descriptions of work done are given; seventeen report titles in response to these task orders are listed.

11451 **(DOE/ET/13053—T5) Technical Support Services to the Division of Fossil Fuels Processing. Quarterly technical progress report for fourth quarter 1979.** (Radian Corp., McLean, VA (USA)). [nd]. Contract AC01-76ET13053. 11p. NTIS, PC A02/MF A01. Order Number DE84005728.

Radian has provided environmental technical support services to ERDA, and now to DOE, in a variety of areas supporting the fossil fuel demonstration programs. Notable studies conducted under this contract have included: site assessments and water availability studies for the demonstration plant facilities: Conoco, ICGG, Grace Ebasco, Memphis, SRC I, and SRC II. Site assessments and water availability studies for the Coalcon Demonstration plant and the Erie Mining project. Criteria for evaluating site suitability of proposed coal conversion facilities in the early planning stage. A guideline document on environmental characterization plan development for coal demonstration facilities. Description of environmental control selection methodology for coal conversion demonstration facilities. A guideline document on health and safety in coal conversion facilities. A comparison of atmospheric fluidized bed conceptual designs for utility steam generation. A review of current practices and research programs in wastewater treatment and solid waste disposal. An assessment of the socioeconomic effects of shutdown of a demonstration facility. Identification of socioeconomic issues associated with the development of peat as an energy source. Radian has also provided DOE with quick reviews of environmental documents, technology transfer requests, and/or quick studies to provide timely technical input to a DOE decision-making process.

11452 **(DOE/PC/51260—4) Boron as a tracer of aerosol from combustion of coal. Final technical report.** Rahn, K.A.; Fogg, T.R. (Rhode Island Univ., Narragansett (USA). Graduate School of Oceanography). 15 Dec 1983. Contract FG22-82PC51260. 30p. NTIS, PC A03/MF A01. Order Number DE84004708.

The main purpose of this project was to study the feasibility of using gaseous and/or particulate boron to trace aerosol from the combustion of coal. Because ofthe great scarity of data on boron, we designed a project to first survey the atmospheric abundances of boron throughout the eastern United States, then use the resulting information to decide its viability as a tracer. We have achieved this basic goal, and have determined that boron is indeed a powerful tracer of aerosol from coal-burning areas. We also learned that gaseous boron is a much more suitable tracer than particulate boron is, and that both are influenced strongly by marine boron in coastal areas. Parallel studies of aerosol alone have also yielded tracers of the Midwest, via the proportions of Se to other trace elements such as As, Zn, Sb, Mn and V. These studies have confirmed the principal conclusion from this boron work, that aerosol from the Midwest reaches various parts of the Northeast regularly and in abundance. The relationships between boron and other trace elements will be developed more fully in the near future. The detailed objectives of our feasibility study were to: (1) survey the concentrations of boron in gas and aerosol at sites in the Northeast, Midwest, and West; (2) attempt to streamline the sampling technique for gaseous and particulate boron, so as to make it more suitable for routine field studies; (3) investigate the feasibility of using nuclear techniques for measuring atmospheric boron. We comment on each of these objectives in the sections below.

11453 **(PB—84-113174) Impact of longwall mining on the hydrologic balance: premining data collection. Open file report, 28 September 1981-28 March 1983.** Evans, G.A.; Hailu, T.; Weagraff, H.M.; Warner, J.W.; Lowry, G.S. (Sato (J.F.) and Associates, Inc., Littleton, CO (USA)). 31 May 1983. 142p. NTIS, PC A07/MF A01.

This report documents a preliminary hydrologic investigation of an area where longwall mining methods are to be used. The scope of work includes determination of physical and chemical characteristics of major soil types in the area; determination of physical and chemical properties of surface water bodies; collection of geologic characteristics, including stratigraphy, structure, and detailed aquifer descriptions; a 10-year collection of meteorological data and installation of a weather station; and a detailed ground water investigation that includes completion of observation wells, aquifer testing, water quality sampling, and analysis using a 3-D computer model. The Trescott model developed by the U.S. Geological Survey was used to simulate steady-state aquifer conditions. Input data from eight multiple-completion monitor wells were used to model an area of approximately 10 square miles. Two confined layers, coal and overburden, were simulated. Model results showed good agreement with known piezometric data, desaturated areas, and flow from springs.

11454 **(PB—84-113182) Survey of blasting effects on ground water supplies in Appalachia. Part 2. Open file report, August 1980-August 1982.** Berger, P.R.; Froedge, D.T.; Gould, J.A.; Kreps, L.F. (Berger (Philip R.) and Associates, Inc., Bradfordwoods, PA (USA)). Aug 1982. 116p. NTIS, PC A06/MF A01.

This report covers an 18-month study of the performance of a 300-ft-deep test water well located at the Ayrshire Mine of the AMAX Coal Co. near Evansville, IN. Well performance, as characterized by 10-hr drawdown tests, was monitored as the strip mining operation approached the well site from distances of 2,000 to 15 ft (overburden removal). Blast-induced ground motion was measured at the surface next to the test well, and peak particle velocities in excess of 4 in/s were obtained. No evidence of changes in water quantity or quality could be directly attributed to the blasts. However, some lowering of the static water level in the observation well, and a simultaneous increase in the adjusted specific capacity of the test well, suggest that overburden removal caused lateral stress relief with consequent opening of vertical fractures.

11455 **Chemical characteristics and acute toxicity of sequentially extracted water-soluble fractions of a coal liquid.** Gray, R.H.; Bean, R.M.; Dauble, D.D.; Fallon, W.E. (Pacific Northwest Lab., Richland, WA). *Environmental Pollution, Series A: Ecological and Biological;* **32**: No. 2, 79-89(1983). Contract AC06-76RL01830.

Chemical characteristics and acute toxicity to Daphnia magna were determined for seven sequentially extracted water-soluble fractions (WSFs) of a solvent-refined coal-II (SRC-II) liquid (2.9:1 blend of middle: heavy distillates). The WSFs were complex mixtures of phenols and aromatic and aliphatic hydrocarbons. Concentrations of total organic carbon (TOC), total oil, total phenols and hydrocarbons in WSFs generally decreased with successive extractions of the coal liquid. The relative contribution of lower molecular weight phenols decreased with successive extractions, while that of higher molecular weight phenols remained constant or increased. Because WSFs were less concentrated with successive extractions, a higher percentage of each successive WSF was needed to induce an acute toxic effect. However, based on TOC, acute toxicities of successive extractions were similar, while based on total phenols, acute toxicity increased. The increase in toxicity in later extracts is attributed to less soluble, higher molecular weight, more persistent phenol classes, and increased relative contributions of aromatic hydrocarbons.

0110 Reserves And Exploration

REFER ALSO TO CITATION(S) 11438, 11439, 11461, 12143

11456 **Coal: an economic interpretation of reserve estimates.** Zimmerman, M.B. (Univ. of Michigan, Ann Arbor). pp 295-332 of Energy resources in an uncertain future: coal, gas, oil, and uranium supply forecasting. Adelman, M.A.; Houghton, J.C.; Kaufman, G.; Zimmerman, M.B. Cambridge, MA; Ballinger Publishing Company (1983).

Part IV examines coal resource and reserve estimation. An attempt has been made in the US to define an economically meaningful classification of coal reserves and resources. This classification is analyzed in detail along with the more-general issue of coal supply. The focus is on already discovered deposits since knowledge of where coal lies is great, and new discoveries play a small role in coal supply. The high upper limit placed on cost increases by category of coal depends on several key assumptions. To know more about the trajectory of costs, we need to know more about coal resources - both the distribution according to seam thickness and the distribution according to other mining conditions. Reserve data tell us only about depletion, however, while cost patterns over time will be affected and likely dominated by factor price behavior and technological change. 30 references, 5 figures, 8 tables.

0120 Mining

REFER ALSO TO CITATION(S) 11485, 11486, 11487, 11488, 11489, 11531, 12456

11457 **(DOE/PC/52274—T4) Mining research and development program. Final report.** (Southern Illinois Univ., Carbondale (USA). Coal Extraction and Utilization Research Center). Dec 1983. Contract FG22-82PC52274. 522p. NTIS, PC A22/MF A01. Order Number DE84004872.

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The Mining Research and Development Program was designed to continue coal research projects initiated in 1979 by DOE in conjunction with SIUC researchers to develop advanced concepts and programs for mining systems and research. This program consisted of two elements: research and development in six project areas; and operation and maintenance of the Carbondale Mining Technology Center (CMTC) as a research facility capable of supporting the above projects. The six project areas of the Mining Research and Development Program were as follows: (1) Hydraulic Fragmentation; (2) Analysis of Economics and Productivity in Strip Mining; (3) Integration of Man and Machine into Efficient Mining; (4) Computer Models for Simulation in Coal Mining; (5) Geotechnical Studies Related to Advanced Mining; and (6) Dragline Simulator Training Systems. Progress in each of these areas is reported.

11458 **(DOE/R4/10333—T2) Utilizing the unconventional gas resources of the Pottsville Formation coals in Tuscaloosa County, Alabama. Final report.** (Alabama Univ., University (USA). School of Mines and Energy Development). Sep 1981. Contract FG44-80R410333. 62p. NTIS, PC A04/MF A01. Order Number DE84005952.

The University of Alabama, with a grant from the Department of Energy, has completed a feasibility study for coalbed methane development on campus. A wireline corehole was drilled to a depth of 2965 feet and core was recovered continuously from the top of the Pottsville Formation. Over 33 lineal feet of coal was recovered of which 31 feet were subjected to desorption analysis. Coal samples were desorbed of gas according to standard US Bureau of Mines techniques for estimating gas content. Coal thickness and gas content data were used to calculate gas resources. The total resource present is nearly 10 billion cubic feet beneath the 760-acre campus. The Mary Lee coal group alone contains more than 3.4 billion cubic feet of gas at 75% recovery. Within the context of the government and industrial experience and given the resource base, projected gas production rates, capital requirements and operating costs, standard techniques of economic analyses indicate that development of University property is feasible but requires careful planning and execution. 4 references, 8 figures, 10 tables.

11459 **(DOE/R4/10336—T1) Feasibility study on the Rockwood Unconventional Gas Project, Rockwood, Tennessee.** (Smith (Wayne L.) and Associates, Inc., Knoxville, TN (USA)). Oct 1982. Contract FG44-80R410336. 89p. NTIS, PC A05/MF A01. Order Number DE84005421.

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The primary purpose of this report is to present the results of the coal sample tests from the Rockwood Unconventional Gas Project, and to determine the financial feasibility of completing production wells if methane were found in sufficient quantities. Unfortunately, the Sewanee seam encountered during the drilling project did not contain significant quantities of gas, and so the project is concluded with the report of the test results.

11460 **(DOE/R4/10371—T2) Fentress County, Tennessee unconventional gas program.** (Hensley-Schmidt, Inc., Chattanooga, TN (USA)). May 1982. Contract FG44-81R410371. 58p. NTIS, PC A04/MF A01. Order Number DE84005848.

In March 1982, an experimental gas well was drilled at the Fentress County Industrial Park site, a 32.5-acre tract adjacent to the northwest corporate limits of the City of Jamestown, Tennessee. The purpose of this well was to determine the feasibility of developing unconventional gas resources throughout the site. This report describes the drilling and testing program, the test results, and an evaluation of the site's feasibility. Results of calculations indicate that if all available gas could be recovered from a 19-inch-thick Nemo coal seam on the 32.5-acee tract, the yield would be approximately 408 cubic feet of gas. At the federally regulated price of $2.59 per cubic foot, the approximate value of the in-place gas would be $1,056.72. Since this calculation is most likely an overestimate of gas volume, there is little feasibility of developing unconventional gas resources at the site.

11461 **(DOE/R4/10371—T3) Unconventional gas - exploratory drilling, Tuscaloosa County, Alabama.** (Goodrich (B.F.) Co., Akron, OH (USA); Alabama Univ., University (USA). School of Mines and Energy Development). Sep 1982. Contract FG44-81R410371. 78p. NTIS, PC A05/MF A01. Order Number DE84005854.

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BF Goodrich owns and operates a large tire manufacturing plant located in Tuscaloosa, Alabama. This plant consumes approximately 3000 MCF of natural gas daily in generating steam for the manufacturing process. In addition, Goodrich has other facilities with requirements for gaseous fuels. Because of increased costs for gas and oil, and forecasted shortages of gas, Goodrich is investigating alternative sources for energy. In the Tuscaloosa vicinity, Goodrich studied in depth the possibility of obtaining methane gas from coal beds. In this process, BF Goodrich worked with the Unites States Bureau of Mines, the University of Alabama School of Mines and Energy Development and various other companies having experience in coalbed degasification. The information available to Goodrich led to the conclusion that degasification may have the potential of meeting the Company's energy and financial objectives. With DOE funding, a test well was drilled and various analyses necessary to verify this potential were made. BF Goodrich management would contemplate investing Goodrich capital to develop production wells if the test well analyses indicated such development to be feasible and the economics of production were consistent with corporate objectives for return on investment. The completed analyses, however, indicate that investment in this program is not justified at this time. 20 figures, 13 tables.

11462 **(DOE/R4/10431—T1) Coal-bed methane resource evaluation, Montgomery County, Virginia.** Stanley, C.B.; Schultz, A.P. (Virginia Div. of Mineral Resources, Charlottesville (USA)). 1983. Contract FG44-81R410431. 97p. NTIS, PC A05/MF A01. Order Number DE84005953.

Three diamond-core holes have been drilled by the Virginia Division of Mineral Resources to assess the coal-bed methane resource of Mississippian coals in a portion of the Valley coal fields near Blacksburg, Virginia. Coals of the upper member of the Mississippian Price Formation were encountered in two holes at depths ranging from 1110 to 1462 feet below the surface. The cored coal samples were immediately sealed in metal canisters, and tests were

made to determine the volume of gas present within each sample. This preliminary report provides details on the regional and local geology of the area under study, the thicknesses, elevations, and gas contents of the coals encountered, and a preliminary economic feasibility analysis. That analysis was performed for the Division of Mineral Resources by Gruy Petroleum Technology, Incorporated, Arlington, Virginia. Their evaluation of the coal-bed methane data suggests that the resource is of marginal value under the assumptions used. However, the potential does exist for future development if one or more of the following criteria are met: (1) thicker coal-bearing intervals with similar gas contents are discovered in other parts of the Valley coal fields; (2) higher coal-bed methane contents are found; and (3) the profit margin is significantly increased because of reduction of development costs and/or increases in gas prices. Because of the complex geologic setting of the Valley fields, the extreme variability of coal thicknesses, and the paucity of subsurface data, further drilling is necessary in order to accurately assess the economic potential of coal-bed methane outside the study area. 15 references, 18 figures, 6 tables.

11463 **(PB—84-100791) Kettlebottoms: their relation to mine roof and support. Report of investigations/1983.** Chase, F.E.; Sames, G.P. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). Aug 1983. 18p. (BM-RI—8785). NTIS, PC A02/MF A01.

Kettlebottoms are columnar masses of rock--the preserved casts of ancient tree stumps--embedded in coal mine roof strata (of which they are a part). Because unsupported kettlebottoms can detach from mine roof without warning, they are a hazard to miners. The primary objectives of this investigation were to better define and describe kettlebottoms and to evaluate kettlebottom support techniques in terms of safety and effectiveness.

11464 **(PB—84-100841) Novel coal-cutting bits and their wear resistances. Report of investigations/1983.** Cheng, L.; Liebman, I.; Furno, A.L.; Watson, R.W. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). Aug 1983. 22p. (BM-RI—8791). NTIS, PC A02/MF A01.

Based on earlier tests that showed steel to be much more likely to cause frictional ignition than tungsten carbide, the Bureau of Mines redesigned coal-cutting bits to reduce the hazard of face ignitions. Two bit designs--a muchroom-shaped bit with a conical shank and a dovetail bit with a rectangular shank--are described, as well as bit wear tests conducted in the laboratory and in an operating coal mine.

11465 **(PB—84-104918) Development of coal gas production simulators and mathematical models for well test strategies (literature survey and computer models for unstimulated vertical wells and for stimulated vertical wells connected to an infinite-conductivity - constant pressure - vertical fracture). Annual report May 81-Apr 82.** Hoysan, P.M.; Pavone, A.M.; Schwerer, F.C. (United States Steel Corp., Monroeville, PA. Research Lab.). Jul 1983. 510p. NTIS, PC A22/MF A01.

A computer program, designated WELL1D and written in FORTRAN, has been developed to simulate the nonsteady (time-dependent), one-dimensional, simultaneous two-phase flow of water and methane gas through a coal seam to either an unstimulated vertical well or to a (hydraulically) stimulated vertical well connected to a high conductivity vertical fracture. The computer model incorporates time-dependent, nonlinear sorption of methane by the coal matrix; a strongly-coupled description of well bore storage, shut-in and variable pump rate effects; and simple economic analysis based on gas production.

11466 **(PB—84-104926) Dewatering systems and techniques for coalbed methane wells. Volume 1. Final report.** McGinnis, N. (TRW Energy Development Group, McLean, VA (USA)). Aug 1983. 161p. (SN—98576). NTIS, PC A08/MF A01.

The production of methane from most coalbeds requires the removal of the water to reduce the hydrostatic pressure and increase the relative permeability to gas flow. This study provides an evaluation of contemporary oil and gas pumping systems for this application. The systems evaluated are sucker rod (beam pumping unit), electric submersible, hydraulic jet, hydraulic piston, plunger lift, and gas lift. Ten well systems were defined to normalize the basis of comparison for the fluid-powered systems. The systems were evaluated for pumping 15 and 200 barrels per day (bpd) of water from depths of 1,000, 2,500, 4,000, and 8,000 feet. Comparisons were developed for equipment, installation, and OandM costs for each system, and combinations of systems when smaller units are used to replace initial installations later in the well life. Subjective rankings were also developed using 17 criteria to reflect individual field situations and environments.

11467 **(PB—84-104934) Dewatering systems and techniques for coalbed methane wells. Volume 2. Final report.** (TRW Energy Development Group, McLean, VA (USA)). Aug 1983. 252p. NTIS, PC A12/MF A01.

The study shows that contemporary oil field systems are adequate for coalbed dewatering. In general, sucker rod systems were preferred for the shallower depths with fluid-operated systems more applicable for the deeper wells. No system was an overwhelming choice based on cost. Oil field electric submersibles were generally oversized for the flow rates and reservoirs used in this study.

11468 **(PB—84-115658) Bureau of mines coal cutting technology facilities at the Twin Cities Research Center. Information circular/1983.** Roepke, W.W.; Wingquist, C.F.; Olson, R.C.; Hanson, B.D. (Bureau of Mines, Twin Cities, MN (USA). Twin Cities Research Center). Sep 1983. 33p. (BM-IC—8951). NTIS, PC A03/MF A01.

Research on coal cutting at the Bureau of Mines Twin Cities Research Center (TCRC) has evolved from a purely mechanical approach, specifically to reduce dust or frictional methane ignitions, into an understanding of the complexity of the cutting system relationships. Achieving an understanding of these relationships requires a wide variety of testing techniques and equipment. Laboratory facilities and the associated equipment exist for shallow to deep cutting in both coal and coal-inclusive rock with any desired bit type. Research efforts with this equipment are providing insight for significant advances to help solve the problems of pneumoconiosis and frictional ignition. This effort will ultimately affect both respirable dust and methane ignitions at the face through better bit design and will increase the salable percent of run-of-mine (ROM) coal processed. It will also affect the design of rotary-drum cutting continuous mining machines (CMM) and longwall machines. This report describes the main features of the coal cutting research facilities at TCRC.

0130 Transport And Handling

REFER ALSO TO CITATION(S) 11418

11469 **(BEOP—23) Dutch National Research Programme on Coal. State of the art relating to the research done per July 1st, 1983.** (Stichting Energieonderzoek Centrum Nederland, Petten). Oct 1983. 185p. (In Dutch). NTIS (US Sales Only), PC A09/MF A01. Order Number DE84750758.

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The Dutch National Research Programme on Coal comprises on August 1, 1983 a total of 158 research projects, which are classified in about 10 subprogrammes. A description is given of the present state of the art of the various programmes and attention is given to the results obtained so far. Four separate abstracts were prepared from new developments.

11470 (BEOP—23, pp 55-56) **High gradient magnetic separation (HGMS) (FDO/Holec, job. 9.1.1).** Oct 1983. (In Dutch). NTIS (US Sales Only), PC A09/MF A01.

In Dutch National Research Programme on Coal. State of the art relating to the research done per July 1st, 1983.

In general experimental results of HGMS were very promising. High pyrite- and ash-removal in combination with a low combustion heat loss were obtained. Wet processes are to be preferred. A review of the best purification results of 4 german coals are given in a table. The results of dry processes in this table are given

between brackets. According to a preliminary study the economic field strength is about 7 tesla.

11471 **(PB—83-256396) Blending Australian coals with Japanese indigenous coals to meet the metallurgical coke requirements of Japanese steel mills.** (Joint Coal Board, Sydney (Australia)). Oct 1978. 19p. NTIS, PC E03/MF E03.

Those properties which serve to indicate the potential of a coal in the traditional coking market are presented in tabular form for thirteen international coals which typify the thirty-odd coal brands used by the Japanese Steel Industry. In addition several commonly used factors have been calculated and tabulated for each coal to allow the reader to estimate the quality of cokes made from the individual coals or from blends of coals. These factors are presented as an aid to technical marketing because consumers occasionally request such information. However their usefulness in predicting coke quality is questionable where Southern Hemisphere coals are concerned as can be seen from actual coke strengths herein.

11472 **(PB—84-119080) Importance of storage on peat quality. A pilot study.** Thoernqvist, T. (Sveriges Lantbruksuniversitet, Uppsala. Institutionen foer Virkeslaera). 1983. 28p. NTIS, PC E04/MF E01.

In this pilot study, the effect of storage on peat quality has been studied. Three piles have been studied, each containing approximately 55 cubic meters of peat. In one of the piles milled peat was stored which contained 15% water at the time the pile was laid up. The second pile consisted of sod peat with a moisture content of 41%. The third pile was peat which had been dewatered with the 'Multibelt method' to a moisture content of 77%. The storage period lasted from August 1982 until January 1983.

11473 **The research and development program in coal-water mixture technology at the Pittsburgh Energy Technology Center.** Chun, S.W.; Voelker, G.E. (U.S. Dept. of Energy). *Energy Technology (Washington, D.C.);* 10: 908-914(Jun 1983). (CONF-830213—).

From 10. energy technology conference; Washington, DC, USA (28 Feb 1983).

The Pittsburgh Energy Technology Center has designed an R&D program to address the problems of converting to coal-water mixture those boilers originally designed to burn coal but which are now using oil. Testing is oriented toward identifying suitable conditions for burning CWM in small industrial boilers. The potential advantages of coal-water-methanol mixtures are also studied. These results must be extrapolated to predict performance of larger industrial units. The long term reliability of CWM is the subject of future PETC tests. A project to develop retrofit technology has been contracted with Combustion Engineering Inc. and with Gulf R&D Co. Other projects will weigh the advantages of retrofit to coal-oil mixture, or pulverized coal. The effect of highly beneficated coal will also be studied.

0140 Combustion

REFER ALSO TO CITATION(S) 11684, 11696, 11697, 11698, 11843, 11850

11474 (BEOP—23, pp 23-24) **Fluidized-bed combustion. Technological University Twente (job 1.2.1.): atmospheric fluidized-bed combustion of coal with in situ removal of sulfur compounds.** Oct 1983. (In Dutch). NTIS (US Sales Only), PC A09/MF A01.

In Dutch National Research Programme on Coal. State of the art relating to the research done per July 1st, 1983.

Promising is a ceramic oxygen electrode (ZrO_2/Y_3O_3) which determines the local air excess in the fluidized-bed. The new instrument is tested in a 4 MW fluidized-bed combustion unit. In a fluidized-bed, oxidizing as well as reducing areas can be clearly detected.

11475 **(DOE/PC/30306—12) Basic combustion and pollutant formation processes for pulverized fuels. Final report, 1 October 1980-30 September 1983.** Germane, G.J.; Smoot, L.D. (Brigham Young Univ., Provo, UT (USA). Combustion Lab.). 31 Oct 1983. Contract FG22-80PC30306. 162p. NTIS, PC A08/MF A01. Order Number DE84005662.

This document summarizes research accomplishments of a thirty-five month study of basic combustion and pollutant formation processes for pulverized fuels. Principal objectives were to measure local product composition and pollutant formation for coal-water mixtures (CWM), to measure the physical and combustion characteristics of several different coal-derived chars and to implement swirling flow and heterogeneous char reactions in the two-dimensional predictive coal combustion characteristics of several different coal-derived chars and to implement swirling flow and heterogeneous char reactions in the two-dimensional predictive coal combustion code (PCGC-2) developed at the Brigham Young University Combustion Laboratory. Additional objectives included a parametric study of the effect of operating variables on CWM combustion and char combustion tests to supplement reactivity and physical property measurements. Contacts with industrial and governmental organizations were to be continued and reports and papers were to be published in order to transfer information to the technical community. 145 references, 65 figures, 21 tables.

11476 **(DOE/PETC/TR—84/2) Photographic analysis of high pressure fluidization phenomena.** Chitester, D.C.; Strakey, J.P.; Saroff, L.; Kornosky, R.M.; Fan, L.S.; Danko, J.P. (Flowpower, Inc., Huntington Station, NY (USA); Ohio State Univ., Columbus (USA). Dept. of Chemical Engineering; New Hampshire Univ., Durham (USA). Dept. of Chemical Engineering). 1983. 26p. NTIS, PC A03/MF A01. Order Number DE84006050.

Experiments were conducted to investigate fluidized-bed characteristics at pressures up to 6485 kPa using nitrogen as the fluidizing gas. The particles under study were coal and char. A two-dimensional bed (1.9 cm x 10.16 cm) was used in the experiments. Photographs taken of this bed using a high-speed camera were studied to obtain a description of fluidized-bed bubbling behavior over a wide range of pressures. 15 references, 8 figures, 1 table.

11477 **(PB—84-100296) Perspective on the current and future uses of Illinois coal by the electric power industry: a technical report. Memo. file.** Bechtel, L.D. (Illinois Legislative Council, Springfield (USA)). Apr 1983. 41p. NTIS, PC A03/MF A01.

Information concerning the current and future uses of Illinois coal is provided, with specific reference to the electric power industry as the largest consumer. Current technology, including the conventional pulverized-coal-fired-boiler unit with and without flue gas desulfurization, is considered. It is noted that the combination of intensive coal cleaning and latest flue gas desulfurization technology is a method by which Illinois coal can be used by the electric utility industry while meeting U.S. Clean Air Act requirements. Using the improved coal in electric utility applications would provide economic savings, including: reduced maintenance and improved reliability of coal pulverizer units; reduced bulk and weight in coal transportation; and reduced ash handling and maintenance of fly ash precipitators. Fluidized-bed combustion and kiln-gasification are identified as two technologies that could use Illinois coal in the future.

11478 **Performance tests of ultra-fine grind coal-oil mixtures in a 150-HP boiler.** Rose, M.J.; Butcher, T.A.; Rogers, E.; Dietz, R.; McDonald, R. (Brookhaven National Lab., Upton, NY). pp 205-209 of Proceedings of the IASTED energy symposia: modelling, policy and economics of energy and power systems; alternative energy sources and technology. Hamza, M.H. (ed.). Anaheim, CA; ACTA Press (1981). (CONF-810574—).

From International Association of Science and Technology for Development energy symposium; San Francisco, CA, USA (20 May 1981).

Performance tests on two-micron pulverized coal in coal-oil slurries burned in 150 H.P. boilers indicate that coal particles agglomerate, producing larger ash particles than if dry micronized coal is used. Conclusions from the Brookhaven National Laboratory test program are that (1) coal-oil fuel flends can be burned in fire-tube boilers designed for oil with no major retrofits beyond automatic soot blowers, and (2) collection devices will be needed until improved coal benefaction is cost effective. 23 references, 2 figures, 5 tables.

11479 **Reversed flow fluidized-bed combustion apparatus.** Shang, J.Y.; Mei, J.S.; Wilson, J.S. US Patent Application 6-445,598. [nd]. 12p.

Paper copy only, copy does not permit microfiche production.

The present invention is directed to a fluidized-bed combustion apparatus provided with a U-shaped combustion zone. A cyclone is disposed in the combustion zone for recycling solid particulate material. The combustion zone configuration and the recycling feature provide relatively long residence times and low freeboard heights to maximize combustion of combustible material, reduce nitrogen oxides, and enhance sulfur oxide reduction.

0150 Marketing And Economics

REFER ALSO TO CITATION(S) 11458, 11461, 11521

11480 **(NP—4770071) Aktionsgemeinschaft Deutsche Steinkohlenreviere GmbH: Business report 1980.** (Aktionsgemeinschaft Deutsche Steinkohlenreviere G.m.b.H., Duesseldorf (Germany, F.R.)). 1981. 46p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84770071.

The managing board's report points out the decreasing primary energy consumption and the developments and the adaptations taken by the coal-mining industry. It reports on the situation of real estate contracts followed by a demonstration of the annual gross balance with balance sheet, profit and deficit account.

11481 **(PB—84-102052) Coal economics data base: review of capabilities of selected models. Final report.** Klein, D.E. (ICF, Inc., Washington, DC (USA)). May 1983. 102p. NTIS, PC A06/MF A01.

The study presents an in-depth review of industrial and coal sector models, and was a preclude to compiling a Coal Economics Data Base. Eleven models were reviewed, spanning a broad range of analytic capabilities from analysis of industrial combustors to overall energy supply and demand. Several models were seen to have potential applicability to GRI's needs with respect to combustion economics for electric utilities and industrial applications, conversion to synthetic fuels, and coal sourcing.

11482 **Structure of international steam-coal markets.** Abbey, D.S. (Los Alamos National Lab., NM); Kolstad, C.D. *Natural Resources Journal;* **23**: No. 4, 859-891(Oct 1983).

A common view is that the international coal market is reasonably competitive and that prices will tend towards long-run marginal costs. However, analyses of many commodities reveal the importance of market imperfections and market power in explaining price formation and trade flows. A review of the structure of the steam coal market suggests the market is not perfectly competitive. Considering industrial concentration, market shares and government policy, it is possible to identify participants with the potential to exercise market power. These include the Republic of South Africa, Australia, and Poland on the supply side and Japan and the European Community on the demand side. 66 references, 3 figures, 9 tables.

0160 Health And Safety

REFER ALSO TO CITATION(S) 11423, 11468, 11697, 11698, 12860

11483 **(DOE/PC/62999—1) Exploratory research on mutagenic activity of coal-related materials using statistical evaluation.** (Cincinnati Univ., OH (USA). Kettering Lab.). 1982. Contract AC22-83PC62999. 24p. NTIS, PC A02/MF A01. Order Number DE84005641.

Preliminary work using ETTM-11 was done to develop assay techniques necessary to carry out specific aims of the research. Salmonella strain TA97 gave the greatest mutagenic response in reverse assays of the four strains tested. TA98 required the least sample for mutagenesis. Use of 1% S9 from Aroclor 1254-treated rats provides the most sensitive and consistent results in a forward mutation assay.

11484 **(PB—83-250886) Electron microscopy studies of explosion and fire residues. Report of investigations.** Ng, D.L.; Cashdollar, K.L.; Hertzberg, M.; Lazzara, C.P. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). Jul 1983. 70p. NTIS, PC A04/MF A01.

This Bureau of Mines report describes the results of scanning electron microscopic (SEM) studies of the combustion residues of carbonaceous dust particles resulting from explosions and thermal ignitions in laboratory and full-scale mine tests. In addition to the experimental studies, results of SEM observations of residues from a mine explosion disaster are reported. Comparison of such residues with those from the laboratory and experimental mine explosions can help investigators determine the extent of dust participation in the disaster and in identifying the possible ignition sources.

11485 **(PB—84-102946) Electrical-shock prevention. Volume 1. Protection of maintenance personnel. Open file report 6 Apr 81-8 Dec 82.** Morley, L.A.; Novak, T.; Trutt, F.C. (Pennsylvania State Univ., University Park (USA)). 8 Dec 1982. 127p. NTIS, PC A07/MF A01.

The overall objective of this research was to investigate the application, economic, and safety considerations of electrical-shock prevention techniques applied to surface and underground mines. Volume I of this four-volume report is primarily concerned with the protection of maintenance personnel. The scope of the work is specified, electrical shock is defined, and needed ground-fault relay characteristics to prevent ventricular fibrillation are established. This is followed by an analysis of ac systems, a comparison of these systems with respect to body currents, the advantages and disadvantages of the various ground-fault protection techniques, and an analysis of dc systems for off-track vehicles. Summaries and synopses of each of the three remaining volumes are included.

11486 **(PB—84-102953) Electrical-shock prevention. Volume 2. Ground-fault interrupting devices. Open file report 6 Apr 81-8 Dec 82.** Morley, L.A.; Trutt, F.C.; Rufft, D.J. (Pennsylvania State Univ., University Park (USA)). 8 Dec 1982. 110p. NTIS, PC A06/MF A01.

Volume II of this report is concerned with the application of sensitive ground-fault interrupters (GFI's) to ac utilization circuits in U.S. mines. The main concepts examined are shock prevention and methods to reduce nuisance tripping. The research involved a literature search, input from previous Bureau of Mines contracts, and contacts with electrical manufacturers and mining personnel. Several devices that showed promise were tested and the results indicate the existence of GFI's that may be modified to perform adequately on U.S. mining systems. A set of guidelines covering design, construction specification, and performance tests is included.

11487 **(PB—84-102961) Electrical-shock prevention. Volume 3. Fault protection for motion-drive equipment. Open file report 6 Apr 81-8 Dec 82.** Morley, L.A.; Trutt, F.C.; Buchan, G.M. (Pennsylvania State Univ., University Park (USA)). 8 Dec 1982. 65p. NTIS, PC A04/MF A01.

Volume III of the report examines the indication versus interruption procedures used on motion-drive power equipment with

emphasis on surface excavators. A review of the electromechanical ac-dc conversion used with the Ward-Leonard control system is presented. Protection for the drive-system components are then discussed. Fault sources and calculations for both the ac supply source and dc power loop are introduced to assist in discussing indication and interruption procedures. The dynamic process of the machine is examined and the effects of fault current and position of the machine to allow for an orderly shutdown is determined. Possible indication and interruption procedures are given for the four-quadrant duty cycle of excavators. The report is concluded by introducing other mining operations that utilize similar motion-drive systems and static (solid-state) drives and recommends further research in these areas, as well as a more detailed examination of the dynamic fault analysis for excavators.

11488 **(PB—84-102979) Electrical-shock prevention. Volume 4. Overhead-line contact fatalities. Open file report 6 Apr 81-8 Dec 82.** Morley, L.A.; Trutt, F.C.; Homce, G.T. (Pennsylvania State Univ., University Park (USA)). 8 Dec 1982. 116p. NTIS, PC A06/MF A01.

Volume IV of the report examines the problem of indirect contact of overhead high-voltage powerlines by mining personnel. This refers to the contact of energized lines by workers through an intermediate conductor such as a metallic tool or a piece of high-reaching mobile equipment. The shock hazard by such contact has been a major cause of electrical fatalities associated with mining operations. The report is divided into three areas. The first gives a general background of overhead lines, basic characteristics, and associated hazards and describes presently used techniques and devices that attempt to alleviate the contact problem. The second area presents a detailed analysis of 39 overhead-line contact accidents in mining since 1970. The third section used the information in the first two areas to formulate recommendations to prevent these accidents and subsequent electrocutions as mining operations.

11489 **(PB—84-116136) Computerized, remote monitoring systems for underground coal mines. Faults in power systems. Information circular/1983.** Welsh, J.H. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). Sep 1983. 18p. (BM-IC—8944). NTIS, PC A02/MF A01.

The Bureau of Mines studied the use of computerized, continuous, remote monitoring systems for safety from power system faults in underground coal mines. In this report the need to improve protection against power system faults is documented, and types of faults are identified. The relationship between mine safety regulations and computerized, continuous, remote monitoring is analyzed.

0170 Legislation And Regulations

11490 **Costs and benefits of federal regulation of coal strip mining.** Kalt, J.P. (Harvard Univ., Cambridge, MA). *Natural Resources Journal;* 23: No. 4, 893-915(Oct 1983).

A quantitative cost-benefit analysis is made of the Surface Mining Control and Reclamation Act of 1977 (SMCRA). The incidence and welfare effects of SMCRA are developed within the context of a multisector model of the US coal industry. It appears that, on net, the national economic costs of SMCRA outweigh the benefits by a fairly narrow margin, although the net effect may be too close to call. In contrast to its national effects, SMCRA appears to produce substantial improvements in resource allocation in certain regions of the country. The important effect of SMCRA, however, lies in the wealth transfers, which are found to be large and, most likely, regressive. 55 references, 5 tables.

02 PETROLEUM

0201 Reserves

REFER ALSO TO CITATION(S) 12143, 12177

11491 **Oil and gas: Estimation of discovered reserves.** Adelman, M.A. (Massachusetts Inst. of Tech., Cambridge). pp 27-81 of Energy resources in an uncertain future: coal, gas, oil, and uranium supply forecasting. Adelman, M.A.; Houghton, J.C.; Kaufman, G.; Zimmerman, M.B. Cambridge, MA; Ballinger Publishing Company (1983).

Part II treats the measurement of already discovered deposits. It examines the concept of proven reserves and the behavior of reserves over time. The rate at which resources flow from discovery estimates to programmed flow depends on investment, operating costs, and on prices. Reserves can thus be priced or costed into or out of existence; the economist's basic objective is to see what difference a price change makes for the hydrocarbon flow. Better knowledge of proved and provable reserves would give us a valuable handle on near-term development outside the US, where public data is dwindling as foreign companies are expelled. 43 references, 21 tables.

11492 **Oil and gas: estimation of undiscovered resources.** Kaufman, G. (Massachusetts Inst. of Tech., Cambridge). pp 83-294 of Energy resources in an uncertain future: coal, gas, oil, and uranium supply forecasting. Adelman, M.A.; Houghton, J.C.; Kaufman, G.; Zimmerman, M.B. Cambridge, MA; Ballinger Publishing Company (1983).

Part III looks at undiscovered deposits to see how suspected deposits are estimated. It criticizes the biases inherent in many of the estimation methodologies because they are like ships passing in the night, with no common links. The oil and gas models currently in vogue range from disaggregated approaches that focus on individual deposits as the basic unit for analysis to models that treat time-series data at the national level. Real progress awaits data acquired according to a design that permits meaningful structural evaluation of highly disaggregated models of deposition, discovery, and production. 194 references, 56 figures, 29 tables.

0202 Geology And Exploration

REFER ALSO TO CITATION(S) 11526

11493 **Reservoir property implications of pore geometry modification accompanying sand diagenesis: Anahuac Formation, Louisiana.** Holland, M.T. (Terra Tex). *Society of Petroleum Engineers of A.I.M.E. (American Institute of Mining, Metallurgical and Petroleum Engineers), Paper;* **SPE 10991**: 1-12(Sep 1982). (CONF-820927—). Contract AC08-79ET27255.

From 57. AIME Society of Petroleum Engineers annual technical conference and exhibition; New Orleans, LA, USA (26 Sep 1982).

This paper represents a study of reservoir pore modification accompanying diagenetic secondary porosity development within a deep (13,400') overpressured Anahuac Formation sandstone in southern Louisiana. Such secondary porosity formed by dissolution of carbonate cement, detrital grains, and other soluble replacive minerals comprises a significant portion of porosity formed in U.S. Gulf Coast Tertiary reservoir sands. The primary pore system within this reservoir was significantly enlarged (up to 35% porosity) by selective dissolution of soluble material by acidic fluids generated during hydrocarbon maturation and shale dewatering. Using scanning electron microscopy, petrographic examination, mercury injection and core testing at in-situ reservoir conditions, characteristics of the reservoir pore system were examined from core within this particular sand interval. Secondary pore size and distribution was found to be affected by sandstone mineralogy, pore matrix content, and sedimentary structures and resulting textural components hindering fluid flow. Special core tests were performed at simulated in-situ reservoir conditions of pressure and temperature to examine

porosity and permeability reduction as a function of effective stress generated by reducing pore pressure (simulated fluid production). Observed mechanical resistance to uniaxial compaction at reservoir conditions was determined within portions of the sand containing high (about 30%) secondary porosity.

0203 Drilling And Production

REFER ALSO TO CITATION(S) 11810

11494 **(SAND—83-1755C) Forecast of drilling technologies.** Carson, C.C. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 16p. (CONF-840373—1-Draft). NTIS, PC A02/MF A01. Order Number DE84005723.

From IADC drilling technology conference; Dallas, TX, USA (19 Mar 1984).

Current drilling for oil and gas resources is predominantly shallow, land drilling, as it has been throughout its history. In the near future, this will change as we are forced to exploit generally deeper and more remote reservoirs. This change in the target resources will cause a gradual change in the technologies we use to reach them. In addition, eventual exploitation of alternative resources will also introduce new drilling requirements. An indication of the coming changes in drilling systems is provided by the current emphases in drilling research and development. These include improvements in bits and downhole motors, measurement while drilling (MWD) development, rig automation, and expanding use of computers. Introduction and continuing modification of the diamond compact bit is one of the most significant recent drilling developments. Much of the recent development and improvement of downhole motors is due to the expanded performance envelopes of PDC bits. MWD is the most active area of current research, with approximately 15 companies developing or marketing systems, and its application is expanding. Rig automation and use of computers to monitor and optimize the drilling function are also slowly growing. By considering the future requirements for drilling systems and the current research emphases, it is possible to anticipate the changes that are likely to occur in the way we drill wells. In general, these will come in the areas of information and control. We will collect more and better information both at the surface and downhole and be better able to process it for use in controlling drilling. Improved control will focus on drilling efficiency and placement of the borehole trajectory. In addition, information will be used to improve drilling safety and formation characterization. 15 references, 8 figures, 1 table.

11495 **Microbiology for enhanced oil recovery.** Donaldson, E.C. (U.S. Department of Energy, Bartlesville Energy Technology Center). *Energy Technology (Washington, D.C.);* **10**: 829-842(Jun 1983). (CONF-830213—).

From 10. energy technology conference; Washington, DC, USA (28 Feb 1983).

The U. S. Department of Energy has sponsored several projects to investigate the feasibility of using microorganisms to enhance oil recovery. Microbes from the Wilmington oilfield, California, were found to be stimulated in growth by polyacrylamide mobility-control polymers and the microbes also can reduce the viscosity of the polyacrylamide solutions. Microbes have been discovered that produce surface active molecules, and several mixed cultures have been developed that make low viscosity, non-wetting, emulsions of heavy oils (°API $<$ 10). Microbial processes are being developed in Canada for applications to heavy oil deposits, in China for enhanced recovery of light oils and successful field tests have been conducted in Romania and Arkansas.

11496 **Measurement of width and pressure in a propagating hydraulic fracture.** Warpinski, N.R. (Sandia Natl. Lab.). *Society of Petroleum Engineers of A.I.M.E. (American Institute of Mining, Metallurgical and Petroleum Engineers), Paper;* **SPE/DOE**: 409-420(Mar 1983). (CONF-830305—).

From SPE symposium on low permeability; Denver, CO, USA (14 Mar 1983).

Measurements of width and pressure in a propagating hydraulic fracture have been made in tests conducted at DOE's Nevada Test Site. This was accomplished by creating an "instrumented fracture" at a tunnel complex (at a depth of 1400 ft) where realistic in-situ conditions prevail, particularly with respect to stress and geologic features such as natural fractures and material anisotropy. Analyses of these data show that the pressure drop along the fracture length is much larger than predicted by viscous theory and currently in use in models today. This is apparently due to the tortuosity of the fracture path, multiple fracture strands, roughness and sharp turns (corners) in the flow path due to natural fractures and rock property variations. It suggests that fracture design models need to be updated to include a more realistic friction factor so that fracture lengths are not overestimated.

11497 **The multiwell experiment core program.** Sattler, A.R. (Sandia Natl. Lab.). *Society of Petroleum Engineers of A.I.M.E. (American Institute of Mining, Metallurgical and Petroleum Engineers), Paper;* **SPE/DOE11763**: 437-444(Mar 1983). (CONF-830305—).

From SPE symposium on low permeability; Denver, CO, USA (14 Mar 1983).

The Multi-Well Experiment (MWX) is a research oriented field laboratory and it is the major production technology activity of the Western Gas Sands Project. A major activity is the core analysis program. Over 3600 ft (1097 m) of core were taken from two wells separated by only about 110 ft (34 m) at depth. All major categories of core analysis are reviewed and results through December 1982 are included. Those include routine core analysis, restored state reservoir parameter measurements, electrical measurements, mechanical rock property data, mineralogy, organic maturation and geochemistry. This paper also describes the laboratory work on core and formation invasion and the development of instruments that were used in the field processing of the core.

11498 **The role of interfacial resistances in alkaline waterflooding of acid oils.** de Zabala, E.F.; Radke, C.J. (Univ. of California). *Society of Petroleum Engineers of A.I.M.E. (American Institute of Mining, Metallurgical and Petroleum Engineers), Paper;* **SPE11213**: 1-20(Sep 1982). (CONF-820927—). Contract AC03-76SF00098.

From 57. AIME Society of Petroleum Engineers annual technical conference and exhibition; New Orleans, LA, USA (26 Sep 1982).

A major problem plaguing alkaline flooding is finding simple and reliable screening tests to predict oil recovery. Interfacial tensions of acid crude oils contacting alkaline water exhibit a remarkable and dramatic dynamic minimum (i.e., $<10^{-3}$mN/m) followed by a slow rise to a very high value (i.e., about 30 mN/m). It is, therefore, difficult to decide which transient tension value is appropriate in an alkaline oil displacement. This paper demonstrates that dynamic tension minima are due to interfacial barriers which inhibit surfactant mass transfer across the oil/water boundary. Upon contact with alkali, the acid in an oil blob diffuses to the oil/water interface, adsorbs, hydrolyzes, desorbs, and convects into the bulk alkaline solution. Slow surfactant desorption into the water phase is perceived as the origin of tension minima. A nonequilibrium tertiary oil displacement model is presented which rigorously incorporates all these transport steps. The authors calculate concentration profiles in the oil and flowing water phases during a displacement, and ascertain how the transient tension actually behaves in time and distance during the alkaline displacement process.

11499 **Thermodynamic modeling of quaternary systems: oil-brine-surfactant-alcohol.** Kilpatrick, P.K.; Davis, H.T.; Scriven, L.E. (Univ. of Minnesota). *Society of Petroleum Engineers of A.I.M.E. (American Institute of Mining, Metallurgical and Petroleum Engineers), Paper;* **SPE11209**: 1-18(Sep 1982). (CONF-820927—).

From 57. AIME Society of Petroleum Engineers annual technical conference and exhibition; New Orleans, LA, USA (26 Sep 1982).

The modelling of quaternary systems is necessary in an accurate treatment of oil-brine-surfactant-alcohol mixtures. Two previous approaches have proven useful in the correlation and prediction of phase split and composition data for these systems, both relying on the pseudoternary approximation. The quaternary version of a thermodynamic model is preferred as it provides for unequal partitioning of alcohol and surfactant in different phases in equilibrium.

A molecular-based free energy model is also preferred because it links directly the forces of constituent molecules to patterns of phase, interfacial, and wetting behavior. A systematic scheme for the computation of phase behavior in a quaternary system begins with the determination of phase equilibria on the ternary faces and proceeds by numerical continuation through the higher dimensional composition space. The calculation is expedited by knowledge of the limits of thermodynamic stability -- the spinodal surfaces -- and all critical points, which serve as beacons to guide the computations in penetrating the tetrahedron. Multiphase equilibria are searched out by both parametric and compositional continuation. The result provides the basis for understanding the patterns of three- and four-phase equilibria in oil-brine-surfactant-alcohol systems.

11500 **Behavior of microemulsions under compression.** Rossen, W.R.; Kohn, J.P. (Univ. of Minnesota). *Society of Petroleum Engineers of A.I.M.E. (American Institute of Mining, Metallurgical and Petroleum Engineers), Paper;* **SPE11210**: 1-13(Sep 1982). (CONF-820927—).

From 57. AIME Society of Petroleum Engineers annual technical conference and exhibition; New Orleans, LA, USA (26 Sep 1982).

Compression to reservoir pressures alters microemulsion phase behavior, on which the success of enhanced oil recovery by microemulsion flooding depends. For convenience, however, phase behavior studies are often conducted at atmospheric pressure. Extrapolating phase behavior from atmospheric to reservoir pressures requires the volumetric properties of each phase under compression, in particular the isothermal compressibility as a function of pressure and composition. The authors present the compressibility at up to 160 bar (158 atm) of several systems of oil and water with surfactants and protosurfactants. They fit the compressibility to simple models for its pressure and composition dependence. The pressure dependence fits the Tait equation in this pressure range; selected high pressure data indicate how the compressibility deviates at much higher pressures. The composition dependence is nearly linear in volume-fraction composition, increasing with oil fraction and decreasing with water fraction. More data are needed to verify this dependence. A simple compressibility cell, first described here, allows both rapid determination of compressibility and direct determination of the phase boundary under compression. The authors observed both phase separation and coalescence of distinct phases with increasing pressure. They do not address here the effect of dissolved gases such as methane, which at high pressures can also affect microemulsion phase behavior.

11501 **Modeling and analysis of the CSAMT geophysical technique results to map oil recovery processes.** Bartel, L.C. (Sandia National Laboratories). *Society of Petroleum Engineers of A.I.M.E. (American Institute of Mining, Metallurgical and Petroleum Engineers), Paper;* **SPE11192**: 1-8(Sep 1982). (CONF-820927—).

From 57. AIME Society of Petroleum Engineers annual technical conference and exhibition; New Orleans, LA, USA (26 Sep 1982).

The mapping of enhanced oil recovery (EOR) processes is important to predict process behavior and to be able to exhibit some control of the process for maximizing the stimulation of oil reservoirs. The controlled source audio-frequency magnetotelluric (CSAMT) electromagnetic geophysical technique shows promise for mapping steamfloods and firefloods. Two field trials were conducted, one at a steamflood tar sand oil recovery experiment and one at a fireflood heavy oil recovery process. An initial report of the results was given previously. In this paper, an analysis is given of the CSAMT results for the two floods along with a comparison with production and posttest results. The result of this work is that the CSAMT technique is a viable technique for mapping these thermal EOR processes. In addition, a discussion of mathematical modeling is given.

11502 **Design, performance, and evaluation of the uniflood micellarpolymer process--Bell Creek Field.** Holm, L.W.; Goldburg, A. (Union Oil Co.). *Society of Petroleum Engineers of A.I.M.E. (American Institute of Mining, Metallurgical and Petroleum Engineers), Paper;* **SPE11196**: 1-29(Sep 1982). (CONF-820927—).

From 57. AIME Society of Petroleum Engineers annual technical conference and exhibition; New Orleans, LA, USA (26 Sep 1982).

Gary Energy Corporation conducted a DOE cost-shared 40-acre Demonstration Pilot project to determine whether or not micellar-polymer flooding is a feasible technique to enhance oil recovery from the Bell Creek Field, Montana. Water injection into the new 40-acre 5-spot pilot pattern began in October 1977 and was to be followed immediately by the micellar-polymer process. However, the complex reservoir definition work extended this pilot 5-spot waterflood to fifteen months, through January 1979. The micellar-polymer (Uniflood) process commenced in February 1979 with preflush injection (16.4% PV); micellar slug injection (3.8% PV) began August 1979 and polymer injection (100% PV) began October 1979. The average remaining oil saturation in the 40 acres was estimated to be 30.5% at the start of chemical injection. This paper includes a summary of the micellarpolymer process design, the micellar-polymer oil recovery results projected to project completion, an analysis of the geology and fluid chemistry within the pilot area, and an interpretation and evaluation of the overall performance of the project. A high pH preflush and the use of a chelating agent in the micellar slug minimized the effects of the multivalent ions present in the reservoir. Also, adjustments in the components used in the soluble oil slug made it possible to regain a favorable phase relationship with the reservoir fluids despite the lower-than-design quality sulfonates.

11503 **Experimental investigation of the steam drive process for the Asphalt Ridge Tar Sands deposit, Utah.** Watts, K.G.; Barbour, R.V.; Hutchinson, H.L.; Johnson, L.A.; Thomas, K.P. (University of Wyoming). *Society of Petroleum Engineers of A.I.M.E. (American Institute of Mining, Metallurgical and Petroleum Engineers), Paper;* **SPE11161**: 1-8(Sep 1982). (CONF-820927—).

From 57. AIME Society of Petroleum Engineers annual technical conference and exhibition; New Orleans, LA, USA (26 Sep 1982).

A series of laboratory experiments was conducted at the University of Wyoming to determine the steamflood recovery mechanisms for the Asphalt Ridge Tar Sands deposit located near Vernal, Utah. Steam at various temperatures and qualities, hot water and also nitrogen were injected into an adiabatic tube containing the tar sands, and the recovery curves were measured. From the results of the experiments, it was concluded that the Asphalt Ridge steamflood mechanisms consist of viscosity reduction, solvent extraction-enrichment, liquid displacement, and steam distillation. In addition to determining the steamflood mechanisms, it was also shown that, for the Asphalt Ridge Tar Sands steam injection recovered more oil than did a hot waterflood at the same temperature; thick, viscous oil was produced during low quality steam runs, whereas a lighter oil was produced at higher qualities; and intermediate quality steam will recover more of the original oil in place than will either high quality steam or hot water.

11504 **Frictional heating and convective cooling of polycrystalline diamond drag tools during rock cutting.** Ortega, A.; Glowka, D.A. (Sandia National Laboratories). *Society of Petroleum Engineers of A.I.M.E. (American Institute of Mining, Metallurgical and Petroleum Engineers), Paper;* **SPE11061**: 1-13(Sep 1982). (CONF-820927—).

From 57. AIME Society of Petroleum Engineers annual technical conference and exhibition; New Orleans, LA, USA (26 Sep 1982).

A numerical-analytical model is developed to predict temperatures in stud-mounted polycrystalline diamond compact (PDC) drag tools during rock cutting. Experimental measurements of the convective heat transfer coefficient for PDC cutters are used in the model to predict temperatures under typical drilling conditions with fluid flow. The analysis compares favorably with measurements of frictional temperatures in controlled cutting tests on Tennessee marble. It is shown that mean cutter wearflat temperatures can be maintained below the critical value of 750° only under conditions of low friction at the cutter/rock interface. This is true, regardless of the level of convective cooling. In fact, a cooling limit is established above which increases in convective cooling do not further reduce cutter temperatures. The ability of liquid drilling

fluids to reduce interface friction is thus shown to be far more important in preventing excessive temperatures than their ability to provide cutter cooling. Due to the relatively high interface friction developed under typical air drilling conditions, it is doubtful that temperatures can be kept subcritical at high rotary speeds in some formations when air is employed as the drilling fluid, regardless of the level of cooling achieved.

11505 **Flow enhancement characterizes design of polycrystalline diamond cutter bits.** Kuhn, K.O.; Forrest, S. (Sii Smith Tool). *Society of Petroleum Engineers of A.I.M.E. (American Institute of Mining, Metallurgical and Petroleum Engineers), Paper;* **SPE11062**: 1-10(Sep 1982). (CONF-820927—).

From 57. AIME Society of Petroleum Engineers annual technical conference and exhibition; New Orleans, LA, USA (26 Sep 1982).

The design and development of a drag bit that utilizes polycrystalline diamond drill blanks requires careful attention to hydraulic design features. For optimum performance and service life, the polycrystalline diamond drill blanks must be kept cool and clean. These critical hydraulic requirements, vital to the survival of the diamond drill blanks, were resolved by optimizing flow velocities across the cutters as well as with the proper distribution of flow volume. This was accomplished with strategically located flow restrictors and the incorporation of numerous interchangeable carbide jet nozzles. Field test results of polycrystalline diamond cutter bit runs in Louisiana and Texas show that significant savings can be realized by using these bits in specific drilling situations.

11506 **The development of structured cavitating jets for deep-hole bits.** Johnson, V.E.; Chahine, G.L.; Conn, A.F.; Fredrick, G.S.; Giacchino, G.J.; Lindenmuth, W.T. (Hydronautics, Inc.). *Society of Petroleum Engineers of A.I.M.E. (American Institute of Mining, Metallurgical and Petroleum Engineers), Paper;* **SPE11060**: 1-8(Sep 1982). (CONF-820927—).

From 57. AIME Society of Petroleum Engineers annual technical conference and exhibition; New Orleans, LA, USA (26 Sep 1982).

The erosion and cleaning effects of jets are enhanced when the degree of cavitation occurring on or near the bottom of the hole is increased. A new, STRuctured Acoustically Tuned Oscillating Jet ("STRATOJET") system causes the formation of large discrete vortex rings that promote cavitation to depths several times greater than for conventional jets. The new nozzle designs are shown to be suitable for existing mechanical drill bits and may even enhance hole cleaning in the absence of cavitation. Recent data on the effect of drilling mud on the amplitude of excitation and some laboratory hole bottom cleaning results are also presented.

11507 **Measurement of formation resistivity changes induced by in-situ combustion.** Lee, D.O.; Wayland, J.R. (Sandia National Laboratories). *Society of Petroleum Engineers of A.I.M.E. (American Institute of Mining, Metallurgical and Petroleum Engineers), Paper;* **SPE11051**: 1-5(Sep 1982). (CONF-820927—).

From 57. AIME Society of Petroleum Engineers annual technical conference and exhibition; New Orleans, LA, USA (26 Sep 1982).

Use of controlled source audio magnetotelluric (CSAMT) techniques to map thermal fronts associated with enhanced oil recovery (EOR) processes depends upon knowledge of the changes in formation electrical resistivity. Measurement of these changes required the development of a technique which survives high temperatures and a very corrosive environment while measuring over a frequency range of 5 Hz to 5000 Hz. The apparatus to make these measurements is described. The results from a laboratory forward dry combustion test in the University of Calgary combustion tube are presented. It is found that there is a two-decade change in the resistivity as the fire front transverses through a region. Also there are indications of the separate zones within a fire front. The importance of these results to interpreting CSAMT data are then considered. The frequency dependency of the resistivity changes suggests means of increasing CSAMT sensitivity of deep oil pay-zone mappings.

11508 **Foam-like dispersions for mobility control in CO_2 floods.** Heller, J.; Kuntamukkula, M.; Lien, C.L. (New Mexico Petroleum Recovery Research Center). *Society of Petroleum Engineers of A.I.M.E. (American Institute of Mining, Metallurgical and Petroleum Engineers), Paper;* **SPE11232**: 1-14(Sep 1982). (CONF-820927—).

From 57. AIME Society of Petroleum Engineers annual technical conference and exhibition; New Orleans, LA, USA (26 Sep 1982).

This paper reports information on the mobility of foam-like dispersions in reservoir rock. The data comes both from the recalculation of selected experimental work reported in the literature, and from new experiments. An important criterion for these is that the influence of fluid compressibility should be eliminated or greatly reduced in importance, so as to more closely approximate field conditions in CO_2 floods. The core flow experiments performed for this work meet this condition by use for the non-aqueous phase of either liquid CO_2 at high pressure, or a light hydrocarbon to simulate dense CO_2 in experiments done at low pressure. It is postulated here that to be effective in retarding the growth of fingers or other instability patterns in CO_2 floods while maintaining a high microscopic displacement efficiency, a foam-like dispersion of dense CO_2 in surfactant/water should have the following characteristics: its aqueous phase content should be as low as possible, to minimize oil trapping and to permit maximum contact between CO_2 and the crude oil, and its effective mobility in the reservoir rock should be adjustable, by some parameters accessible during its generation, to about that of the oil bank it is expected to form and displace.

11509 **Simulation of the LETC/DOE TS-1S steam drive experiment.** Hutchinson, H.L.; Fausett, D.W.; Johnson, L.A.; Kennedy, J.H. (Univ. of Wyoming). *Society of Petroleum Engineers of A.I.M.E. (American Institute of Mining, Metallurgical and Petroleum Engineers), Paper;* **SPE11160**: 1-11(Sep 1982). (CONF-820927—).

From 57. AIME Society of Petroleum Engineers annual technical conference and exhibition; New Orleans, LA, USA (26 Sep 1982).

In conjunction with the LETC/DOE TS-1S Test, a computer simulation study was performed to help define the pattern size and configuration prior to the test, monitor the progress of the test during its operation, and help with post-test interpretation of the results. A multidimensional steamflood model was used to conduct the simulation. Results helped to define the inner and outer pattern sizes for the inverted 5-spot pattern. During the test vertical temperature profiles were matched which suggested significant underrunning of the zone. Post-test coring and matching tended to confirm this behavior and the model also showed that initial oil saturation heterogeneity controlled the fluid movement during the experiment. The model results suggested that about three-fourths of the injected steam left the zone of interest and that fluid movement continued after the test was terminated. Studies of pre-steamflood air injection testing showed that such testing can give indication of areal heterogeneities so that steam movement during the test can be anticipated based on such heterogeneities.

11510 **Pressure transient testing with a partially penetrating well in a two-layer reservoir.** Javandel, I.; Witherspoon, P.A. (Lawrence Berkeley Laboratory). *Society of Petroleum Engineers of A.I.M.E. (American Institute of Mining, Metallurgical and Petroleum Engineers), Paper;* **SPE11139**: 1-9(Sep 1982). (CONF-820927—).

From 57. AIME Society of Petroleum Engineers annual technical conference and exhibition; New Orleans, LA, USA (26 Sep 1982).

An analytic solution has been derived to investigate the transient pressure response of two-layer reservoirs with cross-flow. Results of the analytic method have been verified using a finite-element model and they reveal important details of pressure transient behavior such as the limiting conditions for detecting a multilayer situation. A procedure has been developed to evaluate the permeability of the producing layer as well as that of the second layer. The method can be applied to both pressure buildup and interference well tests. As has been previously shown from earlier numerical techniques, the early-time response or such a two-layer reservoir producing from a fraction of the thickness of one of the layers

closely follows the behavior of a single-layer case. An inflection point in the pressure response can be expected under certain circumstances, and this provides important data. At large times the system behaves like an equivalent homogeneous reservoir.

11511 **Method and apparatus for improved observation of in-situ combustion processes.** Lee, D.O.; Montoya, P.C.; Wayland, J.R. Jr. US Patent Application 6-485,154. [nd]. 30p. Contract AC04-76DP00789.

Method and apparatus are provided for obtaining accurate dynamic measurements for passage of phase fronts through a core sample in a test fixture. Flow-through grid structures are provided for electrodes to permit data to be obtained before, during and after passage of a front there-through. Such electrodes are incorporated in a test apparatus for obtaining electrical characteristics of the core sample. With the inventive structure a method is provided for measurement of instabilities in a phase front progressing through the medium. Availability of accurate dynamic data representing parameters descriptive of material characteristics before, during and after passage of a front provides a more efficient method for enhanced recovery of oil using a fire flood technique. 6 figures, 2 tables.

0204 Processing

REFER ALSO TO CITATION(S) 11523

0205 Products And By-products

11512 **(AD-A—132177/7) Nucleation at a liquid-liquid interface and exploding drops in emulsified fuel combustion.** Avedisian, C.T. (Princeton Univ., NJ (USA). Dept. of Aerospace and Mechanical Sciences). Jul 1976. 125p. NTIS, PC A06/MF A01.

This progress report gives some preliminary observations of the exploding drop phenomenon which sometimes occurs during burning of emulsified fuels. It contains what may be considered a first attempt at explaining the so-called micro-explosin effect which has been observed in the burning of such fuels. The purpose of this work was twofold: 1) to offer an explanation for the droplet explosion effect and thereby predict the temperature at which an emulsified fuel drop would explode; and 2) to report the results of an experimental attempt to measure this maximum or explosion temperature. The model for the explosion phenomenon is based on the assumption is responsible for droplet break-up. An expression for the rate at which bubbles from homogeneously at the interface in the emulsion is responsible for droplet break-up. An expression for the rate at which bubbles for homogeneously at the interface is presented and used to predict the corresponding nucleation temperature.

0207 Marketing And Economics

REFER ALSO TO CITATION(S) 12172, 12175

11513 **(AD-A—133003/4) Future energy and United States security. Student essay.** Spiller, W. Jr. (Army War Coll., Carlisle Barracks, PA (USA)). 13 Apr 1983. 35p. NTIS, PC A03/MF A01.

Coal, nuclear energy, synthetic fuels, renewable energy sources, and conservation were examined as alternative energy sources to petroleum for the United States. These sources offer feasible alternatives for petroleum and will allow for the maintenance of US security. The US can and must enter a multipronged, four phased program designed to reduce oil imports to zero by 1990 and progress toward solar and biomass as primary sources of energy by the year 2000. Technology and domestic energy sources exist for the US and her allies to become energy independent.

11514 **(DOE/EIA—0380(83/12-1)) Petroleum marketing monthly, December 1983.** (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). Jan 1984. 91p. NTIS, PC A05/MF A01 - GPO. Order Number DE84005093.

The preliminary statistics for October 1983, show that total operator sales of selected petroleum products, measured in gallons per day, decreased by 2.1 percent compared to the final September sales data. Substantial decreases in sales were reported for each of the four transportation fuels: motor gasoline, No. 2 diesel fuel, aviation gasoline, and kerosene-type jet fuel. Conversely, large increases were reported in operator sales of No. 2 fuel oil, while sales of the secondary heating fuels (kerosene, No. 1 distillate, and propane), along with sales of No. 4 and residual fuel oils, increased slightly. Total operator sales decreased at both the retail and wholesale levels. Because the smaller operators increased their retail product sales, their share of the total operator market increased slightly. Operator prices were predominantly down, except for retail prices of No. 2 fuel oil, aviation gasoline, and kerosene, and the wholesale prices of kerosene-type jet fuel and low-sulfur residual fuel oil. The average retail price of No. 2 distillate for all sellers similarly increased slightly, primarily as a result of increased sales to residential customers. Sales activity for each of the principal product groups are summarized.

11515 **(NP—4770082) New Zealand - energy situation 1981.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Jan 1983. 21p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84770082.

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The energy situation of this country is reviewed on the basis of some characteristic data. After the national and international energy policy has been commented on the developments with regard to various energy carriers and power generation are described. Some important figures on the foreign trade are given. A statistical appendix contains further detailed data.

11516 **(NP—4770083) Ghana - energy situation 1981.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Jan 1983. 9p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84770083.

The energy situation of this country is reviewed and some remarks are made on the developments on the petroleum sector and the field of electricity. 95% of the electric power generated in Ghana are produced in the two power plants at the lower course of the Volta River.

11517 **(NP—4770084) Portugal - energy situation 1981.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). May 1983. 32p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84770084.

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The energy situation of this country is reviewed on the basis of some relevant data. Its energy policy is commented on and developments in electric power generation are described as well as the trends observed for the various energy sources. Some important figures on the foreign trade are given. The appendix of tables contains some detailed figures.

11518 **(NP—4770085) Situation on the energy and petroleum market of the Federal Republic of Germany.** (Commerzbank A.G., Frankfurt am Main (Germany, F.R.). Abt. Volkswirtschaft und Information). 24 May 1982. 15p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84770085.

About the middle of 1982 the situation on the energy and petroleum market of the F.R. of Germany is characterized by the fact that the structural change of energy consumption is continued. More and more electric power is made from coal. A slight growth in consumption can be observed for power gained from nuclear energy. The natural gas sales is increasingly taking place in households and saving measures as well as substitution reduce petroleum consumption. On the international oil markets there is a trend towards oversupply, the German oil imports show a further downward movement. The German oil bill is, for the first time, liable to a slight regression in the current year and in the long term a continually diminishing oil share is expected.

11519 (NP—4770089) Energy policy between petroleum crisis and petroleum glut. Lantzke, U. (Energieforum Schweiz, Bern (Switzerland)). [nd]. 28p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84770089.

This lecture explains the energy situation in the area of the OECD in the second half of 1982 with special regard to the petroleum supply. Particular attention is payed to the dramatic decrease in the demand for petroleum, its causes and consequences; moreover the future perspectives are outlined. In the discussion that followed, which is also reprinted, the author answered more specific questions, above all regarding the policy and tasks of the International Energy Agency (IEA).

11520 (NP—4770093) WEG annual report 1982. (Wirtschaftsverband Erdoel- und Erdgasgewinnung e.V., Hannover (Germany, F.R.)). 1983. 66p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84770093.

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The report presents, in a detailed form, statistically and cartographically, the domestic natural gas and petroleum production plants as well as the production results. The necessary drilling activities and the geophysical measurements are shown and the considerable foreign activities of the member companies are reported on. Here, a cartographic picture gives information about the energy potential of the North Sea. The report is finished with the staff numbers and a list of the member companies.

11521 (NP—4900732) Tennessee Energy Statistics Quarterly. Second quarter 1983. Finley, T.F. III; Hensley, B.D.; Trotter, T. (Tennessee Dept. of Economic and Community Development, Nashville (USA). Energy Div.). 1983. 37p. Tennessee Department of Economic and Community Development, Energy Div., Suite 707, 226 Capital Boulevard, Nashville, TN 37219.

Three substantive areas of energy flow (production, consumption, and prices) are discussed. Data are included for coal, natural gas, petroleum, and electric power.

11522 World oil. Preliminary results from the energy modelling forum - study. Sweeney, J.L. (Stanford Univ. Stanford, California (USA)). *Kvartalsskrift, Bergen Bank;* No. 3-4, 169-179(1981). (CONF-8105234—).

From Conference on oil and energy; Bergen, Norway (1 May 1981).

The Energy Modeling Forum (EMF) has been addressing a number of world oil issues. The EMF working group consists of 42 members, drawn from government agencies, private sector firms, consulting and research institutions, international organizations, and universities, and includes both modelers and non-modelers. Ten prominent world energy models were applied to 12 scenarios. The results were interpreted in order to examine oil supply, demand and price patterns under various possible future world situations. In the analysis of the world oil market, a number of conclusions were reached that are robust across the models and scenarios. These conclusions relate to the future price and availability of world oil, the impacts of possible supply disruptions, the import premium associated with import reduction measures, and the transition to alternative energy sources. The overall conclusions are not happy ones for the oil importing nations. Even oil exporting nations, such as Norway, which are closely tied economically, politically and militarily to the rest of the western industralized world, may face only a mixed blessing. If the models and scenarios do correctly represent the likely world oil futures, then one can expect the real price of oil to rise significantly, the oil importing nations to remain dependent of those supplies and the era of oil to continue but with higher prices.

0208 Waste Management

REFER ALSO TO CITATION(S) 11527, 11700

11523 (PB—83-261644) Flare efficiency study. Final report, May 1982-March 1983. McDaniel, M. (Engineering-Science, Inc., Austin, TX (USA)). Jul 1983. 145p. NTIS, PC A07/MF A01.

The report gives results of a full-scale experimental study to determine the efficiencies of flare burners for disposing of hydrocarbon (HC) emissions from refinery and petrochemical processes. With primary objectives of determining the combustion efficiency and HC destruction efficiency for both air- and steam-assisted flares under a wide range of operating conditions, it provides a data base for defining the air quality impact of flaring. Test results indicate that flaring is generally an efficient HC disposal method for the conditions evaluated. Test methodology involved a special 27-ft sample probe suspended by a crane over the flare flame.

11524 Process for removing polychlorinated and polybrominated biphenyls from oils. Orlett, M.J. US Patent Application 6-457,591. [nd]. 12p. Contract AC05-76OR00001.

The invention is a relatively simple and inexpensive process for detoxifying oils contaminated with PCBs and/or PBBs. The process is especially suitable for processing lubricating oils containing such contaminants. In one aspect of the invention, the contaminated lubricating oil is contacted with a particulate reagent comprising adsorbent particles carrying a dispersion of metallic sodium. The solid sodium reagent converts the PCB and/or PBB contaminants to environmentally acceptable products and also converts various sodium-reactive additives normally present in lubricating oil to reaction products. The adsorbent reagent retains most of the products and is easily separated from the detoxified oil. The detoxified oil may be fortified with various additives functionally equivalent to those removed during detoxification.

0209 Environmental Aspects

REFER ALSO TO CITATION(S) 11684, 12731

11525 (AD-A—133693/2) Development and calibration of an oil spill behavior model. Final report. Mackay, D.; Shiu, W.Y.; Hossain, K.; Stiver, W.; McCurdy, D. (Toronto Univ., Ontario (Canada). Dept. of Chemical Engineering and Applied Chemistry). Sep 1982. 94p. NTIS, PC A05/MF A01.

An oil spill behavior model has been developed which describes the changing area, thickness and physical properties of spills of Prudhoe Bay Crude Oil, No. 2 fuel (home heating) oil and No. 4 (heavy) fuel oil under Arctic marine conditions. The oil properties calculated are density, viscosity, pour point, aqueous solubility, flash point, fire point and interfacial tension. The model calculations include spreading into thin (sheen) and thick slicks, drift, evaporation, dispersion, and formation of water-in-oil emulsions (mousse formation). The model was calibrated by fitting the model equations to data obtained from outdoor weathering experiments conducted at the Coast Guard RandD Center, Groton, Connecticut, during the Winters of 1979/80 and 1980/81 in which arctic spring conditions were simulated. A comprehensive sampling program yielded data on the changing oil properties. The model successfully described the rate of evaporation and the physical properties under these test conditions, with the exception that interfacial tensions were not well predicted. This exception is probably due to the formation of surface active compounds by oil oxidation, and water-in-oil emulsion formation induced by rainfall. It is believed that the model provides the capability of predicting, with acceptable accuracy, the behavior and properties of the three oils when spilled under arctic marine conditions.

11526 (PB—83-257923) Report to SOTEAG (Shetland Oil Terminal Environmental Advisory Group) on numbers of Tysties ('Cepphus grylle') in the area of the Yell Sound Island, August 1981. Heubeck, M. (Technische Hogeschool Delft (Netherlands). Dept. of Applied Physics). [nd]. 13p. NTIS, PC E03/MF E03.

A survey was conducted in late August 1981 when most of the young birds had fledged and were identifiable on the water as juveniles. The total number of Tysties (Cepphus grylle) was very similar to the 1980 figure. The ratio of adults to juveniles was higher in 1981, but this figure was not thought very reliable. A number of Tysties were also recorded outside the area of the survey; it was not known whether these birds move into the area of

the Yell Sound. The numbers of Tysties recorded remained well below the pre-1978 level, before the 'Esso Bernicia' oil spill.

11527 **(PB—84-102169) Evaluation of subsurface conditions at refinery land treatment sites. Final report Nov 80-Apr 82.** Brown, K.W.; Deuel, L.E. Jr. (Texas A and M Univ., College Station (USA)). Sep 1983. 131p. NTIS, PC A07/MF A01.

Soil cores were collected at 5 different sites that had been used for land treating refinery oily waste. Core samples were also collected from similar but untreated areas adjacent to the treated ones. Samples were analyzed for various constituents in an attempt to evaluate potential movement of the waste from the sites. Data indicates that metals from the waste applied to these sites typically remained in the treatment zone. Chromium did move to depths below the zone of incorporation in one site with acidic soil. At most sites low concentrations of hydrocarbons were found below the zone of incorporation. The potential for downward migration is typically greatest in coarse-textured, sandy soils, and less in fine-textured soils. Textural discontinuities appeared to help slow the downward movement of hydrocarbons.

11528 **(PB—84-112366) Oil, shrimp, mangroves: an evaluation of contingency planning for the Gulf of Guayaquil, Ecuador. Technical report.** Filho, I.P. (Woods Hole Oceanographic Institution, MA (USA)). Oct 1983. 107p. (WHOI—83-38). NTIS, PC A06/MF A01.

The possibility of finding oil in the Gulf of Guayaquil has led several Ecuadorian agencies to prepare contingency plans to deal with the eventuality of an oil spill in the area. This report characterizes the importance of the oil and fisheries industries to the Ecuadorian economy, and describes the region where these activities may conflict. It also elaborates on the biological effects of oil in tropical environments, and on aspects of prevention, control/clean- up and oil spill contingency planning. Compensation for oil pollution damages and methods for damage assessment are also discussed herein.

0230 Properties

REFER ALSO TO CITATION(S) 12397

11529 **(AD-A—130743/8) Research on fire-resistant diesel fuel flammability mitigation mechanisms. Interim report, 13 May 1980-31 December 1982.** Weatherford, W.D. Jr; Naegeli, D.W. (Southwest Research Inst., San Antonio, TX (USA). Army Fuels and Lubricants Research Lab.). Dec 1982. 57p. (AFLRL—165). NTIS, PC A04/MF A01.

The development of aqueous fire-resistant diesel fuel (FRF) microemulsions has been reported previously. Flammability and ballistic tests reveal diminished mist flammability, and such tests demonstrate rapid self-extinguishment of pool fires even at temperatures above the base fuel flash point. A basic study has been conducted to develop an improved understanding of the mechanisms by which such self-extinction occurs. An ignition-limits apparatus was developed, utilizing an evacuatable autoclave at one atmosphere. Measurements made with diesel fuel vapor in air, diluted with various amounts of water vapor, established that such mixtures containing more than about 24 mole% water vapor cannot burn. Vapor pressure measurements, made in a modification of the same apparatus, confirmed that FRF systems containing 10 vol% water and 6 vol% surfactant are blanketed by equilibrium vapors containing at least 24 mole% water for liquid temperatures greater than about 70 C. The flash points of diesel fuel FRF blends containing 10% water are about the same as those of the base fuel when its flash point is less than about 70 C. When the base fuel flash point exceeds 70 C, no flash point is detectable for the FRF.

11530 **Interpretation of pressure-composition phase diagrams for CO_2-crude oil systems.** Orr, F.M.; Jensen, C.M. (New Mexico Institute of Mining and Technology). *Society of Petroleum Engineers of A.I.M.E. (American Institute of Mining, Metallurgical and Petroleum Engineers), Paper;* **SPE11125**: 1-22(Sep 1982). (CONF-820927—).

From 57. AIME Society of Petroleum Engineers annual technical conference and exhibition; New Orleans, LA, USA (26 Sep 1982).

This paper examines the types of pressure-composition phase diagrams which occur for two ternary systems, CO_2-propanehexadecane and CO_2-methane-hexadecane, and describes transitions from one type of diagram to another which occur with changes in system temperature or changes in oil composition. Nine experimentally determined diagrams are presented for mixtures of Wasson crude oil with CO_2. Three different oils, stock tank oil, stock tank oil plus 312 SCF/BBL solution gas and stock tank oil plus 602 SCF/BBL solution gas, were each studied at three temperatures, 90°F, 105°F and 120°F. Comparison of the resulting phase diagrams with those discussed for the simpler ternary systems indicates that the principal features of the crude oil phase diagrams are qualitatively consistent with those of the ternary systems. The results of the CO_2-crude oil experiments indicate that for low temperature systems (below about 120°, 50°C), the extrapolated vapor pressure of CO_2 is a good estimate of the pressure required to produce a dense, relatively incompressible CO_2-rich phase which can extract hydrocarbons efficiently from a crude oil. Hence, in the absence of other experimental evidence, the extrapolated vapor pressure curve can be used as a rough estimate of the minimum miscibility pressure for low temperature reservoirs.

0250 Combustion

REFER ALSO TO CITATION(S) 11696, 12437

03 NATURAL GAS

0301 Reserves

REFER ALSO TO CITATION(S) 11491, 11492, 12143

0302 Geology And Exploration

REFER ALSO TO CITATION(S) 11458, 11459, 11460, 11461, 11462, 11493

11531 **(DOE/R4/10400—T1) Deep River development project for unconventional gas: exploratory drilling and completion. Final report.** Beutel, R.A. (Beutel (Richard A.) and Associates, Inc., Chapel Hill, NC (USA)). Sep 1982. Contract FG44-81R410400. 54p. NTIS, PC A04/MF A01. Order Number DE84005556.

Portions are illegible in microfiche products.

The purpose of the drilling of a core test was to recover coal samples for the Deep River coal beds in order to determine the methane content of the coal beds with depth. The overall objective was to input data to the DOE as a part of their overall program to provide seed money to aid in the location of alternate energy sources throughout the country. All of the coal and shale sections of the Cummnock Formation were successfully recovered. Successively these were the Black Shale, Cummnock Coal and Gulf Coal, all of the Triassic period. In the three zones sampled, namely the Black Shale, the Cummnock Coalbed and the Gulf Coalbed, the gas recoveries to date have been 2995 cc/gm, 9015 cc/gm and 7379 cc/gm respectively. The only contaminant present in any significant quantity was slightly less than 11% nitrogen in the black shale sample. Based on the results obtained, the gas appears to be a good quality pipeline gas. The Grant from North Carolina was then utilized in order to determine the possible commercial significance of the test. These monies were used to fracture the hole using 42,000 lbs. of sand, 124,000 SCF of nitrogen and other chemical additives. The fluids were injected into the hole under high pressure and volume in order to open the maximum drainage area in the potentially productive sections. The treatment was successful and the well is currently being tested. Testing will continue for several months in order to determine a measure of the productive potential of the test. 19 references.

11532 Potential natural gas resources of Canada. Procter, R.M.; Taylor, G.C. (Dept. of Energy, Mines and Resources, Calgary, Alberta T2L 2A7). *Energy Technology (Washington, D.C.);* 10: 49-55(Jun 1983). (CONF-830213—).

From 10. energy technology conference; Washington, DC, USA (28 Feb 1983).

The Geological Survey of Canada has prepared estimates of gas reserves by the Monte Carlo probability methodology. Four major regions of Canada are surveyed. Substantial potential remains to be discovered in fairly shallow Lower Cretaceous sediments in the Western Canada sedimentary basin. Diapiric structures formed by shale intrusions are a major target in the Mackenzie Delta–Beaufort Sea region. The main focus of exploratory effort in the Sverdup Basin of the Arctic Islands region has been for hydrocarbons trapped in anticlinal or domal structures. A sedimentary wedge around Hibernia is the center of the East Coast region. The TCF of each region--35, 9, 15, and 72-are summarized, respectively.

11533 Subducted organically derived gas: A new research direction in unconventional deep-source gas. Gwilliam, W.J. (U.S. Department of Energy, Morgantown Energy Technology Center, Morgantown, West Virginia). *Proceedings, Intersociety Energy Conversion Engineering Conference;* 2: 1072-1080(Aug 1982). (CONF-820814—).

From 17. Intersociety Energy Conversion Engineering conference; Los Angeles, CA, USA (8 Aug 1982).

It is proposed herein that the cyclical process of subducting large quantities of organic-bearing ocean sediment beneath the Earth's crust via plate tectonics has provided the means by which the mantle and deeper portions of the Earth's crust have been recharged with hydrocarbons (principally methane) and other reactive carbon compounds. Mechanisms of source-emplacement, migration, and entrapment of hydrocarbons arising from deep sources via a subducted organic-origin gas hypothesis for deep-source methane are discussed and they may suggest methods for detection.

0303 Drilling, Production, And-Processing

REFER ALSO TO CITATION(S) 11465, 11466, 11467, 11494, 11504, 11505, 11506, 11510

0304 Products And By-products

11534 (IEA/CREAS—84/02) Methanol production from natural gas or coal. Stratton, A.; Hemming, D.F.; Teper, M. (International Energy Agency Coal Research, London (UK). Economic Assessment Service). Dec 1982. 64p. (EAS/E—4/82). NTIS, PC $90.00.

This is an examination of the comparative economics of natural gas and coal as feedstocks for methanol production. Two cases representing the variety of coal types and technology, e.e., a bituminous coal example using a Texaco gasifier and a sub-bituminous coal example using a Lurgi gasifier are compared with that of a modern methanol plant based on gas. Allowances are made for the great difference in production capacity and for the use of data based on different processes. As natural gas becomes more expensive, coal starts to become the more attractive feedstock. The report indicates the range of natural gas prices at which this occurs.

0306 Marketing And Economics

REFER ALSO TO CITATION(S) 11520, 11521, 12181

11535 (IEA/CREAS—84/05) Economics of gas from coal. Teper, M.; Hemming, D.F.; Ulrich, W.C. (International Energy Agency Coal Research, London (UK). Economic Assessment Service). Jan 1983. 128p. (EAS/E—2/80). NTIS $144.00.

This study deals with three questions: What does gas from coal cost and what affects this cost; How do different approaches and processes compare; and How near to competitive cost-levels is present-day technology. Discussion covers production of both substitute natural gas (SNG) and medium calorific gas (MCG: 10-16 MJ/Nm3 or 250-400 Btu/SCF). Conclusions are that SNG from low-cost U.S. coal and West German brown coal are, on the basis of mature technology and Government rates-of-return, roughly competitive with gas imports into the U.S. and Europe respectively. Similarly MCG from second-generation gasifiers is competitive with gas-oil or No. 2 heating oil in Europe, North America and Japan. However, capital costs form about half total gas costs at 10 percent rate-of-return, so that the competitiveness of gas from coal is sensitive to capital costs: this is the area of greatest uncertainty.

11536 (OTA-TM-E—12) US natural gas availabiity: conventional gas supply through the year 2000. A technical memorandum. (Office of Technology Assessment (U.S. Congress), Washington, DC). Sep 1983. 98p. GPO.

The assessment examines the future potential for production of all forms of natural gas in the US Lower 48 States, emphasizing the time frame 1990 to 2000. Production will depend primarily on gas available from the growth of already-discovered fields, from new discoveries of conventional gas, and from the exploitation of unconventional gas sources. The efficacy of different generic resource assessment methods was examined, specific estimates were reviewed, specific areas of uncertainty were discussed, and conclusions about a plausible range for the size of the conventional gas resource are described. Trends in reserve additions and production, leading to a production potential to the year 2000. Finally, the potential from gas sources other than domestic production was reviewed.

11537 (PB—84-114909) U.S. natural gas availability: conventional gas supply through the year 2000. Technical memo. (Office of Technology Assessment (U.S. Congress), Washington, DC). Sep 1983. 106p. (OTA-TM-E—12). NTIS, PC A06/MF A01.

This technical memorandum is an interim product of OTA's assessment of U.S. Natural Gas Availability. The technical memorandum discusses the future availability of conventional gas -- gas that can be produced at prices and with technology that are relatively close to today's. It first examines the efficacy of different generic resource assessment methods, reviews specific estimates of remaining gas resources, describes and evaluates areas of uncertainty about the magnitude of these resources, and describes conclusions about a plausible range for the size of the conventional gas resource. It discusses trends in reserve additions and production, leading up to a projection of production potential to the year 2000. Finally, it reviews the potential from gas sources other than domestic production.

0308 Environmental Effects

11538 (UCRL—90150) Simulations and parameter variation studies of heavy gas dispersion using the SLAB model - condensed. Morgan, D.L. Jr.; Kansa, E.J.; Morris, L.K. (Lawrence Livermore National Lab., CA (USA)). Dec 1983. Contract W-7405-ENG-48. 12p. (CONF-830802—1-Summ.). NTIS, PC A02/MF A01. Order Number DE84005210.

From International Union of Theoritical and Applied Mechanics symposium on atmospheric disperation of heavy gases and small particles; Delft, Netherlands (28 Aug 1983).

Portions are illegible in microfiche products.

We are employing the SLAB model in ongoing studies of the atmospheric dispersion of heavy gases. SLAB computer simulations of four of the Burro series large-scale 40-m^3 liquefied natural gas (LNG) spill experiments at China Lake, California have been successful in predicting distances to the lower flammability limit (LFL). WE have used this model in simulations of three of the Coyote series of experiments as well as in parameter variation and sensitivity studies and improved simulations of some of the Burro tests. The parameters studied include source rate, wind speed, atmospheric stability, type of source gas, and source duration, as well as the parameters important to certain physics submodels. 8 references, 5 figures.

0309 Artificial Stimulation

REFER ALSO TO CITATION(S) 11496

11539 **(PB—84-100437) Exploration and production program for locating and producing prospective aquifers containing solution gas and free gas - Texas Gulf Coast. Final report1 Feb 81-31 Jan 83.** Gregory, A.R.; Lin, Z.S.; Reed, R.S.; Morton, R.A.; Ewing, T.E. (Texas Univ., Austin (USA). Bureau of Economic Geology). Jul 1983. 209p. NTIS, PC A10/MF A01.

The Port Arthur field, Jefferson County, Texas, was selected as a prospective watered-out gas field that is favorable for application of secondary enhanced gas recovery methods. This field contains multiple watered-out gas reservoirs, multiple thick aquifers, and gas stringer sandstones at depths of 10,850 to 11,700 ft. Sidewall core data show that the average porosity is 30 percent and average permeability is 60 md. Reservoir simulation studies predict that 5.10 x 1,000,000,000 standard cubic feet of gas can be recovered by natural flow from the 'C' sandstone over an 8-year period by reducing reservoir pressure from 6,632 to 4,309 psig. The breakeven gas price is $2.40 per thousand standard cubic feet for a 15-percent rate of return after payment of Federal income taxes. Results of reservoir modeling also predict that a field test would pay off the original investment in 3 years.

0330 Properties

11540 **(PB—84-123397) Measurement of in-situ hydrate thermodynamic properties. Final report, May 1981-May 1983.** Sloan, E.D. (Colorado School of Mines, Golden (USA)). Sep 1983. 46p. NTIS, PC A03/MF A01.

Natural gas hydrates are considered to be a significant resource for natural gas in sediments and in rock. While many properties of hydrates have been determined, virtually no properties of hydrates in sediments have been measured. This work is to measure heat capacities and heats of fusion of hydrates in sediments. Measurements were made on tetrahydrofuran (THF) hydrates due to the complete miscibility of THF with water. A differential scanning calorimeter was purchased and interfacing with a microprocessor was accomplished. It was shown that sediments do not have a significant surface effect on hydrate formation conditions. Actual in-situ hydrates were obtained from Leg 84 of the National Science Foundation Deep Sea Drilling Program in the Middle American Trench. These samples were distributed to the scientific/engineering community. Future work will be on the in-situ hydrates themselves.

0340 Combustion

REFER ALSO TO CITATION(S) 12247, 12437

04 OIL SHALES AND TAR SANDS

0401 Reserves And Exploration

REFER ALSO TO CITATION(S) 11531, 11543, 11548

11541 **(DOE/R4/10200—T2) Regional resource assessment and feasibility analysis of fossil energy recovery from Chattanooga (Devonian) oil shale in Alabama and adjacent states. Report of Phase II investigations, final report.** (Alabama Univ., University (USA). School of Mines and Energy Development). 30 Aug 1982. Contract FG44-80R410200. 58p. NTIS, PC A04/MF A01. Order Number DE84005850.

An engineering plan and economic evaluation are presented for mining and processing 33,000 tons/day of oil shale at a specific site in Madison county, Alabama. The proposed operation is designed to produce about 10,000 bbl/day of oil from shale containing 13 gal/ton of recoverable oil as determined by the modified Fischer assay method. Disposal of mine overburden and spent shale are included as part of the mining plan. The oil is recovered from the shale using the Paraho retorting process. The estimated capital cost of the integrated mining-processing venture is about $800 million, and the annual operating costs are $71 million. At a projected market value of $40/bbl of shale oil plus an additional revenue of $60 million from sale of process by-products the return on investment from the operation before taxes is estimated to be 13% (late 1981 dollars). In addition to the economic evaluation of the integrated mining and processing operation in northeast Alabama, the progress made in developing innovative methods for processing Eastern oil shale are discussed. The results of three different approaches to extracting the oil are presented. Flotation of an Alabama shale containing 11 gal/ton of oil (Fischer assay) gave a concentrate containing 18 gal/ton of oil with a recovery of 96.6 percent of the oil. A preliminary economic evaluation of the retorting of beneficiated and raw shale indicated that the cost of oil recovered by flotation-retorting is in the range of about $6.50/bbl less than the cost of oil produced by retorting unbeneficiated shale. 26 references, 15 figures, 18 tables.

11542 **(DOE/R4/10200—T3) Regional resource assessment and feasibility analysis of fossil energy recovery from Chattanooga (Devonian) oil shale in Alabama and adjacent states. Report of Phase I investigations.** (Alabama Univ., University (USA). School of Mines and Energy Development; Alabama Geological Survey, University (USA)). 3 Jun 1981. Contract FG44-80R410200. 113p. NTIS, PC A02/MF A01. Order Number DE84005849.

The primary objective of this project was to assess the resource potential and economic feasibility of recovering synthetic hydrocarbons, uranium and other by-products from the Devonian Chattanooga Shale in Alabama and adjacent states. Phase I of the proposed multiphase project consisted essentially of the following investigative elements: regional surface sampling; site-specific core drilling; Fischer assays, proximate analyses, oxide analyses, trace element analyses; economic feasibility of the Paraho and HYTORT processes in light of data from the above; preliminary evaluation of commercialization potential of innovative processes such as liquefaction of oil shale with liquid catalysts. The results of work completed in Phase I allow the following conclusion to be drawn: oil content of surface and/or core samples from the deformed shales of Northeast Alabama and Northwest Georgia is very low (generally 1 gal/ton or less). Oil content assays of a limited number of surface samples collected in Madison County, Alabama, and Marshall County, Tennessee, indicate that the Chattanooga Shale in this region would probably yield an order of magnitude more synthetic hydrocarbons (10 to 13 gal/ton) than the shales in the folded region (Valley and Ridge Province); commercialization of oil shale in the study area is not feasible at current world prices for conventional crude; liquefaction of oil shales of the study area, with their characteristically low hydrogen-carbon ratios, is a promising novel method for recovering oil from eastern shale deposits, but further research to determine its commercial applicability is required; and ultimate viability of an oil shale industry in Alabama and adjacent states may depend upon the combined results of oil price escalations, more exploration and testing to delineate the highest quality deposits, and continued research on improving hydrocarbon and by-product recoveries. 13 references, 3 figures, 15 tables.

0403 Drilling, Fracturing, And Mining

REFER ALSO TO CITATION(S) 11548

0404 Oil Production, Recovery, And Refining

REFER ALSO TO CITATION(S) 11501, 11541, 11548

11543 **(DOE/R4/10195—T1) Commercial feasibility of Mississippian and Devonian oil shales of Kentucky.** Robl, T.L. (Kentucky Univ., Lexington (USA). Inst. for Mining and Minerals Research). Apr 1983. Contract FG44-80R410195. 256p. NTIS, PC A12/MF A01. Order Number DE84005418.

This research represents an extension of the Buffalo Trace Area Development District Study (BTADD) of the potential for commercial oil shale development in northeastern Kentucky (Lewis

and Fleming Counties). This study concluded that a shale oil industry, based on eastern oil shales was economically feasible. In addition, it highlighted areas requiring further research. These include the need for: (1) additional oil shale resource assessment, and (2) a better understanding of the fundamental retorting properties of eastern oil shale. To further elucidate the physical and chemical trends found in Lewis and Fleming Counties, the resource assessment for this project was extended to the five counties south of Lewis and Fleming: Rowan, Bath, Montgomery, Powell and Estill. The components of this work included stratigraphy and chemistry of the oil shales, identification and correlation of high carbon zones of potential economic interest, and the calculation of high grade shale resources by mining category. The processing technology examined in the previous study was a modification of the Paraho indirect mode retort, which was originally developed for western US oil shale. Western oil shale differs from eastern in terms of gross chemical composition (eastern oil shales are silicates, western are primarily carbonates) and also in terms of the nature of their kerogen (eastern oil shales produce relatively more coke and potentially more gas upon retorting). These differences make obvious the need to examine the fundamental retorting properties of eastern oil shales. To this end, a bench-scale retorting system was built. This equipment was used to determine the impact of such parameters as heating rate and sweep-gas flow-rate upon oil yield. 92 references, 17 figures, 20 tables.

11544 **(PB—84-114479) Caustic extraction of alumina and soda from dawsonite-bearing oil shale. Report of investigations.** Asai, G.; Mauser, J.E.; Lincoln, R.L.; Henry, J.L. (Bureau of Mines, Albany, OR (USA). Albany Research Center). Sep 1983. 27p. (BM-RI—8796). NTIS, PC A03/MF A01.

The Bureau of Mines investigated the caustic extraction of alumina and soda from retorted dawsonite-bearing oil shale, as part of a program to devise technology for treating alternative domestic sources of alumina for the production of aluminum metal. Colorado oil shale yielding 13 pct oil (35 gal/ton) and containing 12 wt-pct dawsonite (representing about 4 pct extractable alumina) was retorted to obtain oil-free (spent) shale. Spent shale was leached with dilute NaOH to determine the effect of particle size, retorting temperature, leaching variables, and storage conditions on extraction of alumina and soda and dissolution of impurities.

11545 **Design of a field experiment for air-steam co-injection for oil recovery in a Utah Tar Sand.** Laski, G.O.; Fahy, L.J.; Martel, R. (Intercomp Resource Dev. and Engineering Inc.). *Society of Petroleum Engineers of A.I.M.E. (American Institute of Mining, Metallurgical and Petroleum Engineers), Paper;* **SPE11159**: 1-18(Sep 1982). (CONF-820927—).

From 57. AIME Society of Petroleum Engineers annual technical conference and exhibition; New Orleans, LA, USA (26 Sep 1982).

This paper presents the design of the US-DOE Laramie Energy Technology Center's projects TS-4 which involves both in-situ reverse combustion and steamflooding, using a numerical simulator. The simulator showed that the combustion could be limited and contained in a middle 10-foot interval with a correlatable high permeability streak within the 65-foot pay zone of the upper Rimrock tar sand formation in Northwest Asphalt Ridge, Uintah County, Utah. A high transmissibility path was assumed to obtain adequate injectivity and sustain a stable reverse combustion. Combustion 'echoes' developed and the front changed into a forward mode as the formation pressure increased and at very low air-injection rates. Oil recovery was accelerated by pre-heating the formation with the combustion before steamflooding the entire sand.

11546 **Results of mathematical modeling of modified in-situ oil shale retorting.** Braun, R.L.; Diaz, J.C.; Lewis, A.E. (Lawrence Livermore National Laboratory). *Society of Petroleum Engineers of A.I.M.E. (American Institute of Mining, Metallurgical and Petroleum Engineers), Paper;* **SPE11000**: 1-20(Sep 1982). (CONF-820927—).

From 57. AIME Society of Petroleum Engineers annual technical conference and exhibition; New Orleans, LA, USA (26 Sep 1982).

The Lawrence Livermore National Laboratory (LLNL) has developed a one-dimensional mathematical model to simulate modified in situ retorting of oil shale. In this paper the authors discuss the application of the model to commercial-scale retorting conditions. The model was tested by comparing calculated values to those measured in experimental retort runs performed at LLNL. There was generally good agreement between the calculated and observed results for oil yield, temperature profiles, and the yields of most gas species. Retorting rates were consistently overestimated, although the average error was less than 10%. The model is a useful tool for the design and control of retort operations, and for identifying and interpreting observations that differ from model predictions. The model was used to predict the results for modified in situ retorting on a commercial scale, focusing on larger retorts and larger shale particle sizes than could be investigated experimentally.

0405 Properties And Composition

REFER ALSO TO CITATION(S) 11541, 11542, 11548

11547 **Development of eastern shale oil in Kentucky.** Jones, J.E.M. (Dept. of Energy Research and Development, Lexington, Kentucky). *Energy Technology (Washington, D.C.);* **10**: 815-828(Jun 1983). (CONF-830213—).

From 10. energy technology conference; Washington, DC, USA (28 Feb 1983).

The Buffalo Trace study of 1980 renewed interest in shale oil development in Kentucky. This paper reviews the progress of R&D programs since the Buffalo Trace study. Kentucky's shale oil is located in the Cincinnati arch, in the central part of the state. The shale has a true clay base, and yields oil that is more aromatic, and has a lower pour point than western shale. (Detailed comparison with western shale is presented elsewhere). New techniques, such as an analytic pyrolysis technique, for geochemical evaluation, determination of optimum retorting parameters, and simulated retorting, are described. A sampling program is discussed. State pilot programs have faltered due to proprietary problems and cost. But two commercial projects-the American Syncrude project located in the Fleming-Rowan county area, and the Southern Pacific Petroleum project near Means in Menifee county--are in the planning stages. Participants and specifications are detailed.

0406 Direct Uses And By-products

REFER ALSO TO CITATION(S) 11544

0408 Marketing And Economics

REFER ALSO TO CITATION(S) 11541, 11542

11548 **(DOE/R4/10193—T3) Chattanooga shale to synthetic fuel - feasibility study. Phase II. Final report.** (Tennessee Technological Univ., Cookeville (USA)). Sep 1981. Contract FG44-80R410193. 195p. NTIS, PC A09/MF A01. Order Number DE84005851.

The conversion of eastern oil shale into a synthetic liquid fuel has received considerable attention in recent years due not only to the desire for the country to become energy efficient but to the many problems associated with the development of western shale. In an effort to assess the potential of Tennessee's Chattanooga Shale as a source of shale oil, a two-phase study was undertaken at Tennessee Technological University. The first phase was directed to the analysis and characterization of Chattanooga Shale in selected counties in Tennessee. These sites were those where plant locations were deemed possible and the quantity of recoverable shale was estimated to be of sufficient amount to make mining and processing potentially feasible. Phase II of the project, herein reported, was a study of a specific site in Putnam County that has a high potential for commercialization. It essentially covered an assessment of recoverable shale oil, characterized the site specific shale, and determined preliminary mining requirements of the site selected. In addition, the public issues relating to development were reviewed including environmental considerations at the selected site and State and Federal regulations that would impact on the mining and

processing of the shale. Under presently available technology and crude oil prices, underground mining of Chattanooga Shale at the site would be uneconomical. 4 figures, 2 tables.

11549 **Competition and synthetic-fuels industries: the case of oil shale.** Sheerin, J. pp 16-18 of Proceedings of the IASTED energy symposia: modelling, policy and economics of energy and power systems; alternative energy sources and technology. Hamza, M.H. (ed.). Anaheim, CA; ACTA Press (1981). (CONF-810574—).

From International Association of Science and Technology for Development energy symposium; San Francisco, CA, USA (20 May 1981).

This paper considers the competitive implications of the emergence of a synthetic-fuels industry in the US in the 1980's. It uses as an example oil shale, which is the foremost contender among domestic synthetic fuel resources to make a noticeable contribution to US energy liquid fuel supplies. This paper briefly highlights pertinent facts concerning technology sponsorship and the pace of development. Following this, the paper considers a number of present and potential issues that may have the effect of constraining the apparent competitiveness of the emerging industry. Traditional concerns such as concentration of resource holdings, horizontal integration of multinational corporations, barriers of entry, etc. are discussed; but considerable attention is placed upon problems generated by treatment of synfuels by US federal programs themselves. The latter include the patterns of financial assistance which is forthcoming and possible anti-competitive implications associated with the availability of oil shale leases under current arrangements. 9 references, 2 tables.

0410 Enviromental Aspects

11550 **(PB—84-120351) Groundwater quality monitoring recommendations for in situ oil shale development.** Everett, L.G.; Kelly, K.E.; Hoylman, E.W.; Tempo, K. (Environmental Protection Agency, Las Vegas, NV (USA). Environmental Monitoring Systems Lab.). Sep 1983. 177p. (EPA—600/4-83-045). NTIS, PC A09/MF A01.

This study addresses the two primary groups of uncertainties regarding the implementation of a groundwater quality monitoring program for MIS oil shale development such as proposed for Federal Prototype Lease Tracts C-a and C-b. Hydrogeologic characterization, an essential element in siting monitor wells and for the design of the wells to obtain consistent and representative samples, is discussed in terms of geophysical and hydraulic methods that are employed on the Federal Tracts. These methods are also appropriate for other areas with oil shale stratigraphy. Geophysical and hydraulic methods are evaluated and ranked relative to cost, potential effectiveness, and availability of testing equipment in the oil shale region. Sampling methods are discussed, covering a wide variety of monitoring elements.

05 NUCLEAR FUELS

REFER ALSO TO CITATION(S) 12344

0501 Reserves

REFER ALSO TO CITATION(S) 11579, 12143

11551 **(GJBX—11(83)) Uranium and thorium occurrences in New Mexico: distribution, geology, production, and resources, with selected bibliography. Open-file report OF-183.** McLemore, V.T. (New Mexico Bureau of Mines and Mineral Resources, Socorro (USA)). Sep 1983. 486p. NTIS, PC A21/MF A01. Order Number DE84004972.

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Over 1300 uranium and thorium occurrences are found in over 100 formational units in all but two counties, in all 1- by 2-degree topographic quadrangles, and in all four geographic provinces in New Mexico. Uranium production in New Mexico has surpassed yearly production from all other states since 1956. Over 200 mines in 18 counties in New Mexico have produced 163,010 tons (147,880 metric tons) of U_3O_8 from 1948 to 1982, 40% of the total uranium production in the United States. More than 99% of this production has come from sedimentary rocks in the San Juan Basin area in northwestern New Mexico; 96% has come from the Morrison Formation alone. All of the uranium reserves and the majority of the potential uranium resources in New Mexico are in the Grants uranium district. About 112,500 tons (102,058 metric tons) of $30 per pound of U_3O_8 reserves are in the San Juan Basin, about 55% of the total $30 reserves in the United States. Thorium reserves and resources in New Mexico have not been adequately evaluated and are unknown. Over 1300 uranium and thorium occurrences are described in this report, about 400 of these have been examined in the field by the author. The occurrence descriptions include information on location, commodities, production, development, geology, and classification. Over 1000 citations are included in the bibliography and referenced in the occurrence descriptions. Production statistics for uranium mines that operated from 1948 to 1970 are also included. Mines that operated after 1970 are classified into production categories. 43 figures, 9 tables.

11552 **(GJBX—11(83)App.1) Uranium and thorium occurrences in New Mexico: distribution, geology, production, and resources. Appendix 1.** McLemore, V.T. (New Mexico Bureau of Mines and Mineral Resources, Socorro (USA)). Sep 1983. 628p. NTIS, PC A99/MF A01. Order Number DE84004971.

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The following compilation of uranium and thorium occurrences, prospects, deposits, and mines and their descriptions is the most comprehensive tabulation of natural-occurring radioactive occurrences in New Mexico to date. It is possible that many additional occurrences will be discovered in the future. For the purposes of this compilation any locality where uranium or thorium mineralization is reported or produced, or where uranium or thorium concentration exceeds 0.001%, or where the radioactivity is twice background radioactivity or greater is considered an occurrence.

11553 **Some aspects of long-term availability of uranium.** De Vergie, P.C. (Data Systems and Analysis Div., Grand Junction Area Office, Department of Energy, CO (USA)). pp 345-360 of Nuclear power experience. Proceedings of an international conference held by the IAEA in Vienna, 13-17 September 1982. Vol. 3 is entitled "Nuclear fuel cycle". Vienna, Austria; International Atomic Energy Agency (1983). (CONF-820914—Vol.3; IAEA-CN—42/263).

From International conference on nuclear power experience; Vienna, Austria (13 Sep 1982).

A computer-based model called RAPP (Reserves and Potential Projection) has been utilized to determine reasonable limits to future production available from estimated potential uranium resources. The model structure incorporates a breakdown of the sequence of events from exploration through production. Initial assumptions are made for the geologic type of resource occurrence, rate of conversion of the potential resources to reserves, and exploration and production lead times and constraints. Sensitivity studies have been carried out on production capability projections from the International Uranium Resource Evaluation Program (IUREP) speculative resources. Variations in assumptions for production expansion constraints and resource development rates cause the most significant changes in projected uranium production. The modelling studies conducted to date on the IUREP speculative resources indicate that, even using very conservative factors for resource discovery and development rates and production lead times, such resources can make a significant contribution to uranium supply over the next several decades.

11554 **Uranium: estimates of US reserves and resources.** Houghton, J.C. (Geological Survey, Washington, DC). pp 333-384 of Energy resources in an uncertain future: coal, gas, oil, and uranium supply forecasting. Adelman, M.A.; Houghton, J.C.; Kaufman, G.; Zimmerman, M.B. Cambridge, MA; Ballinger Publishing Company (1983).

Part V treats uranium which, like coal, has high extraction costs and must reckon with cost estimation in estimating reserves. And, like oil and gas, the discovered position of the resource base is only a small portion of the resources likely to be exploited over

time. The first two chapters in this section describe the Grand Junction Office (GJO) program of estimating reserves, and interpret GJO statistics based on geological analogy. Subsequent chapters describe other estimation methods, with a case study illustrating trend projection and crustal abundance models and probability assessment. 49 references, 14 figures, 4 tables.

0502 Exploration

REFER ALSO TO CITATION(S) 11542

11555 (GJBX—39(83)) Grade assignments for models used for calibration of gross-count gamma-ray logging systems. George, D.C.; Heistand, B.E.; Krabacher, J.E. (Bendix Field Engineering Corp., Grand Junction, CO (USA). Grand Junction Operations). Dec 1983. Contract AC13-76GJ01664. 63p. NTIS, PC E05/MF $5.75. Order Number DE84005352.

Includes 11 sheets of 24x reduction microfiche.

This report presents the results of work conducted to make grade assignments for 45 calibration models at the US Department of Energy (DOE) calibration facility in Grand Junction, Colorado, and at six secondary field sites in the United States. The assignments which were made carry three restrictions. First, these grade assignments are intended to be used when calibrating gross-count, or total-count, gamma-ray logging systems. Second, the assignments are made only for models which contain only uranium, that is, negligible thorium and potassium. Third, these grade assignments are based solely on gamma-ray measurements performed both in the laboratory and on the models themselves; therefore, they are assignments made from measurements of radium-226 daughters, but are stated in units of equivalent uranium (eU), where equivalent uranium is defined as the concentration of uranium (in naturally occurring isotopic abundance) which would be present if the entire uranium decay chain was in secular equilibrium. In theory, grade assignments can be made by analyzing, in the laboratory, physical samples from the calibration models. However, in practice, the physical sampling process contains uncertainties and leads to laboratory results which are inconsistent with gamma-ray measurements in models. Therefore, the gamma-ray measurements from the models are compared with the results from the laboratory analysis, and the laboratory values are subsequently adjusted to produce a best estimate of the grade in the model. The advantage of this method is that the laboratory data produce assignments which are traceable to standards, while the gamma-ray data from the models produce assignments which are consistent from one model to another. 13 references, 10 figures, 14 tables.

11556 (PB—84-119411) Uranium exploration and extraction. R and D programe: reports on research sponsored under the first phase, 1978-1980 (indirect action). (Commission of the European Communities, Luxembourg). [nd]. 148p. (EUR—7986-EN). NTIS, PC E07/MF E07.

The three-year program on exploration for, and extraction of, uranium within the EEC aims at increasing the self-supply as well as improving and developing technology. Phase I included 21 projects in two areas - exploration methods and techniques, and extraction and recovery. These were divided into three topics each and sub-divided into projects. Summary reports are given on mineralogical and geochemical subjects, test and measurement studies on uranium distribution and radon content of formations, the calibration of exploration instrumentation (i.e. scintillometers and spectrometers), leaching of ores, the recovery and processing of U from low-grade resources, and U recovery from the oceans.

0503 Mining

REFER ALSO TO CITATION(S) 11552

0504 Feed Processing

REFER ALSO TO CITATION(S) 11556, 11638

11557 (CEA-R—5232) Study of the properties of dialkyl thiophosphoric acids. Application to the extraction of U, in phosphoric and nitric solutions. Benjelloun, N. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France); Strasbourg-1 Univ., 67 (France)). Sep 1983. 259p. (In French). NTIS (US Sales Only), PC A12/MF A01. Order Number DE84750471.

A study is made of complex formation and liquid-liquid extraction of uranium (VI) by dialkyl-thiophosphoric acids of formula $(RO)_2POSH$ and by the synergic mixtures: dialkylthiophosphoric acids-phosphine oxides. The aqueous phases studied consist of concentrated phosphoric acid solutions and nitric acid solutions. Several methods, including distribution coefficient measurements, U.V., visible and infrared absorption spectrophotometries and magnetic resonance, were used to study the extraction mechanisms and the structures of species formed in the organic phase. The influence of different parameters (partition of extraction agent, dimerisation, acid ligand-phosphine oxide association, extraction of inorganic acids..) on the uranium (VI) distribution coefficients enabled the constants of complex formation in the aqueous phase and extraction in the organic phase to be determined. These various properties were compared with those of dialkyl phosphoric and dithiophosphoric acids. The mechanisms established prove that sulfur donors ligands form stable complexes with UO_2^{2+} ions although U(VI) is considered as a "hard class a" acceptor according to Ahrland's classification.

0505 Enrichment

11558 Uranium enrichment. Technology, economics, capacity. Voigt, W.R. Jr.; Saire, D.E.; Gestson, D.K.; Peske, S.E. (Department of Energy, Washington, DC (USA)); Vanstrum, P.R. (Union Carbide Corp., Oak Ridge, TN (USA). Nuclear Div.). pp 41-58 of Nuclear power experience. Proceedings of an international conference held by the IAEA in Vienna, 13-17 September 1982. Vol. 3 is entitled "Nuclear fuel cycle". Vienna, Austria; International Atomic Energy Agency (1983). (CONF-820914—Vol.3; IAEA-CN—42/422).

From International conference on nuclear power experience; Vienna, Austria (13 Sep 1982).

Large-scale enrichment of uranium has now been carried out for 40 years. While the gaseous diffusion process was the original choice of several countries and continues today to provide the major component of the world production of separative work, the last two decades have witnessed the development of a number of alternative processes for enrichment. These processes, which are being studied and deployed around the world, offer a wide range of technical and economic characteristics which will be useful in assuring adequate capacity to meet projected reactor fuel market needs through the rest of this century at competitive prices. With present uncertainties in future enriched uranium needs, it is apparent that flexibility in the deployment and operation of any enrichment process will be one of the prime considerations for the future. More economical production of separative work not only can have a beneficial impact on reactor fuel costs, but also tends to conserve natural uranium resources. This paper reviews the world scene in the enrichment component of the fuel cycle, including existing or planned commercial-scale facilities and announced R+D efforts on various processes.

0507 Fuels Production And Properties

11559 Fission-gas releases during post-irradiation annealing of UO_2 fuel from WAGR pins of burn-up up to 5500 MWd/te U. Bridge, D.G.; Cordall, D.; Young, J. Risley, England; UKAEA Risley Nuclear Power Development Establishment (1982). 50p. (ND-R—720). H.M.S.O., London, price Pound 3.00.

Post-irradiation annealing techniques have been applied to UO_2 fuel taken from discharged WAGR pins as part of a programme to determine the extent and nature of the release of fission gases at certain fuel temperatures. The UO_2 of burn-up up to 5500 MWd/te U was heated to 1400° and 1650°C in a helium-hydrogen sweep gas for periods of up to 62 hours. Values for the fission-gas diffusion rate parameter estimated from the steady gas release rates occurring during the 1400°C periods ranged from 3×10^{-14} to 2×10^{-11} sec^{-1}. The overall fractional releases for the anneals, to which large contributions were generally made by bursts of gas obtained on heating to the higher temperatures, ranged from 0.13 to 29%. The release of fission gas, which in no case was associated with grain-size changes, frequently occurred in pulses, even under steady temperature conditions. This type of release pattern is thought to be the result of gas bubbles in the grain boundaries coalescing to form open porosity networks. The reasons for the wide variation in overall fractional releases, and possible differences between in-pile and out-of-pile release rates from fuel at the same temperature are discussed. It is concluded that a post-irradiation anneal of several hours duration, particularly if the annealing temperature is much higher than the irradiation temperature, is unlikely to yield a result applicable to fuel at the same temperature in-pile.

11560 Method of controlling crystallite size in nuclear-reactor fuels. Lloyd, M.H.; Collins, J.L.; Shell, S.E. US Patent Application 6-426,365. [nd]. 12p. Contract W-7405-ENG-26.

Improved spherules for making enhanced forms of nuclear-reactor fuels are prepared by internal gelation procedures within a sol-gel operation and are accomplished by first boiling the concentrated HMTA-urea feed solution before engaging in the spherule-forming operation thereby effectively controlling crystallite size in the product spherules.

11561 Gas tungsten arc welder. Christiansen, D.W.; Brown, W.F. US Patent Application 6-445,604. [nd]. 19p. Contract AC06-76FF02170.

A welder for automated closure of fuel pins by a gas tungsten arc process in which a rotating length of cladding is positioned adjacent a welding electrode in a sealed enclosure. An independently movable axial grinder is provided in the enclosure for refurbishing the used electrode between welds.

0508 Spent Fuels Reprocessing

REFER ALSO TO CITATION(S) 11596, 11926

11562 (AD-A—131389/9) DU (depleted uranium)'chip recovery program. Phase I. A machining study for the production of contaminant-free chips. Final report 5 Jan-5 Jul 83. Conboy, J.; Shevchik, P. (South Creek Industries, Inc., Rexford, NY (USA)). Jul 1983. 52p. NTIS, PC A04/MF A01.

The present depleted uranium (DU) machining process used in the production of the M774 and M833 DU penetrators incurs excessive costs due to the necessity for burial of the radioactive metal turnings (chips). The alternative to burial was the recycling of the chips to form usable depleted uranium thereby eliminating disposal problems and increasing the supply of depleted uranium. An inert atmosphere was proposed to produce contaminate-free chips that will allow remelting to required chemical specifications of the penetrator material. A lathe enclosure was designed to provide a controlled atmosphere of argon gas maintaining a positive pressure of 0.25 psi within. Dry argon gas was used as a coolant at the tool workpiece interface. The chips were analyzed for oxygen and carbon content; the contaminants most critical to the remelting of the chips. The chemical analysis showed consistently low oxygen and carbon pick-up. The significance of these results was substantiated by the successful melting of depleted uranium chips in an electric resistance furnace at AMMRC.

11563 (EUR—7936) Programme of research and development on plutonium recycling in light-water reactors; indirect nuclear action. (Commission of the European Communities, Brussels (Belgium). Directorate General for Research, Science and Education). 1982. 124p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE83703889.

This report is a summary of the results obtained during the five-year programme 'Plutonium recycle in LWRs' (1975-79) which has been made possible after the completion of the synthesis studies on 'Control and Safety' and on the 'Environmental impact'. The work performed during the programme is reported; the contracts concluded and their main results and conclusions are summarized. The activity was devoted to studies of general interest and to R and D in order to improve the scientific and technical knowledge of plutonium recycling. General studies included an assessment of the environmental impact of plutonium recycling as well as research aimed at reducing this impact. Improvements were achieved on neutron-physics parameters of the actinides, on neutron computer codes for plutonium-fuelled LWRs, on control and safety and on the in-pile behaviour of mixed-oxide fuels. The conclusions state that, while fostering a fruitful exchange of information in the community, the programme has contributed to demonstrating the feasibility of plutonium recycling in LWRs.

11564 (ORNL/TM—8953) Consolidated Fuel Reprocessing Program. Progress report, July 1-September 30, 1983. (Oak Ridge National Lab., TN (USA)). Jan 1984. Contract W-7405-ENG-26. 41p. NTIS, PC A03/MF A01. Order Number DE84006241.

Preconceptual studies for the proposed Breeder Reprocessing Engineering Test (BRET) Project have been completed. Results from studies on plutonium polymerization during steam-jet transfers of nitric acid solutions containing Pu(IV) and dissolution tests on irradiated Fast-Flux Test Facility fuel are reported. Tests on the remote titrator were completed. A computer-aided analysis of a scale-model BRET rotary dissolver was completed. Progress continued on all construction, modification, and installation projects in the Integrated Equipment Test facility. Estimates were proposed for development and hardware costs of a high-speed uranium/plutonium analysis system to be used in controlling the BRET centrifugal contractors. Design objectives for the Joint Prototype Head-End Facility have been revised, and the Joint Fuel Processing Demonstration 100% particle breakage test was successfully completed. Major efforts of the environmental, safeguards, waste management, and nuclear engineering tasks were directed toward providing data for the BRET. The status of various engineering systems studies is reported.

11565 The effects of zirconium on the dissolution rate of thoria in nitric-hydrofluoric acid solutions. Tallent, O.K.; Buxton, S.R.; Campbell, D.O.; Mailen, J.C. (Oak Ridge National Laboratory, Chemical Technology Division, P.O. Box X, Oak Ridge, Tennessee 37830). *Nuclear Technology;* 60: No. 3, 395-405(Mar 1983).

Dissolution tests using ThO_2 microspheres, ThO_2 pellets, and Zircaloy tubing were performed to establish conditions that can be used for the selective dissolution of thoria from Zircaloy cladding. Although additional work is needed in several areas, the following conditions are tentatively recommended for use in process demonstration tests: 0.02 to 0.04 M HF in refluxing 8 to 12 M HNO_3 with sufficient Al^{3+}, or (preferably) Zr^{4+}, added to prevent major corrosion of the stainless steel dissolver vessel. If Zr^{4+} is used, the concentration required is approximately the same molarity as the fluoride concentration.

0509 Transport And Storage

REFER ALSO TO CITATION(S) 11597, 11599, 12361, 12466

11566 (CEGB-P—22) Sizewell 'B' power station public inquiry: CEGB proof of evidence. Transport of irradiated fuel. Womack, G.J. (Central Electricity Generating Board, London (UK)). Nov 1982. 117p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE83703874.

The safe transport of irradiated fuel is discussed. Firstly the amount of fuel to be handled, the storage of irradiated fuel at the station, the design of the flask to be used and its cost, and the operations and maintenance involved in operating a flask are considered. The regulations for the safe transport of radioactive material are then described. Possible accident situations and their radiological consequences are discussed. It is concluded that the risk to the population and the environment is very small.

11567 **(CEGB-P—23) Sizewell 'B' power station public inquiry: CEGB proof of evidence. The transport of irradiated fuel by rail.** Singleton, L. (Central Electricity Generating Board, London (UK)). Nov 1982. 118p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE83703875.

Details are given of the transport of flasks of irradiated fuel by British Rail. Arrangements which have been made for safety on the railways are discussed. Particular arrangements for flask safety and emergency procedures laid down in case of a rail accident are outlined. Extracts from British Railways publications are included as Appendices to the proof. These publications are: the British Railways Rule Book, the Working Manual for Rail Staff, the Board's Byelaws and the List of Dangerous Goods Conditions of Acceptance.

11568 **(CONF-831217—5) Costs and impacts of transporting nuclear waste to candidate repository sites.** McSweeney, T.I.; Peterson, R.W.; Gupta, R. (Battelle Columbus Labs., OH (USA)). 1983. Contract AC02-83CH10140. 11p. NTIS, PC A02/MF A01. Order Number DE84005297.

From 5. civilian radioactive waste management information meeting; Washington, DC, USA (12 Dec 1983).

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In this paper, a status report on the current estimated costs and impacts of transporting high-level nuclear wastes to candidate disposal sites is given. Impacts in this analysis are measured in terms of risk to public health and safety. Since it is difficult to project the status of the nuclear industry to the time of repository operation - 20 to 50 years in the future - particular emphasis in the paper is placed on the evaluation of uncertainties. The first part of this paper briefly describes the characteristics of the waste that must be transported to a high-level waste disposal site. This discussion is followed by a section describing the characteristics of the waste transport system. Subsequent sections describe the costs and risk assessments of waste transport. Finally, in a concluding section, the effect of the uncertainties in the definition of the waste disposal system on cost and risk levels is evaluated. This last section also provides some perspectives on the magnitude of the cost and risk levels relative to other comparable costs and risks generally encountered. 13 references, 2 figures, 16 tables.

11569 **(CONF-840116—2) US Department of Energy Transportation Programs: computerized techniques.** Joy, D.S.; Johnson, P.E.; Fore, C.S.; Peterson, B.E. (Oak Ridge National Lab., TN (USA)). Jan 1984. Contract W-7405-ENG-26. 27p. NTIS, PC A03/MF A01. Order Number DE84005815.

From 63. annual meeting of Transportation Research Board; Washington, DC, USA (16 Jan 1984).

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The US Department of Energy is currently sponsoring the development of four specialized transportation programs at Oak Ridge National Laboratory. The programs function as research tools that provide unique computerized techniques for planning the safe shipment of radioactive and hazardous materials. Major achievements include the development of rail and highway routing models, an emergency response assistance program, a data base focusing on legislative requirements, and a resource file identifying key state and local contacts. A discussion of each program and data base is presented, and several examples reflecting each project's applications to the overall DOE transportation program are provided. The interface of these programs offers a dynamic resource of data for use during preshipment planning stages. 9 references, 10 figures, 2 tables.

11570 **(DOE/SR/11036—T3) Single assembly heat transfer test.** Anderson, R.T. (Allied-General Nuclear Services, Barnwell, SC (USA)). Aug 1983. Contract AC09-83SR11036. 81p. NTIS MF A01. Order Number DE84005622.

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Accurate prediction of spent fuel rod temperatures under low power conditions is a necessary step in developing feasible dry storage techniques. This report presents the test plan for a highly instrumented simulated spent fuel assembly. A major objective of the testing is to permit accurate prediction of the relative efforts of the conduction, natural convection and radiation heat transfer modes. Tests conducted on this simulated assembly will embody various gases, attitudes, rod powers, and boundary conditions. The results of the tests will be used to benchmark computerized thermal models used to design and verify dry storage casks. 12 figures, 2 tables.

11571 **(EGG—2268) Evaluation of alternatives for a second-generation transportation system for Department of Energy transuranic waste.** (EG and G Idaho, Inc., Idaho Falls (USA)). Jan 1984. Contract AC07-76ID01570. 83p. NTIS, PC E07/MF $7.75. Order Number DE84005827.

Includes 19 sheets of 24x reduction microfiche.

Department of Energy (DOE) waste storage sites will ship their contact-handled (CH) and remote-handled (RH) transuranic (TRU) waste to the Waste Isolation Pilot Plant (WIPP) beginning FY 1989. The CH-TRU waste will be shipped in the Transuranic Package Transported (TRUPACT-I), a new packaging being developed by Sandia National Laboratories, Albuquerque/Transportation Technology Center. Some of the DOE TRU waste, however, might be unsuitable for shipment in TRUPACT-I, and is designated special-shipped (SS) TRU waste. The purposes of this study were to: (1) identify the quantity and characteristics of SS-TRU waste stored and generated at DOE facilities; (2) identify alternatives for managing the SS-TRU waste; and (3) make overall recommendations for managing the SS-TRU waste. Data on quantity and characteristics were gathered through coordinating visits to the sites and extracting information from each site's records. Representatives of DOE organizations and contractors set objectives for managing the SS-TRU waste. Alternative shipping systems were then identified for CH SS-TRU waste and RH SS-TRU waste. Evaluations of these alternatives considered how well they would satisfy each objective, and associated potential problems. The study recommends delaying the decision on how best to transport the CH SS-TRU waste to WIPP until the amount of SS-TRU processed waste in heavy drums is known. These conditions and choices are presented: a relatively small number of processed, heavy drums could be shipped most economically via TRUPACT-I, mixed with lighter drums of unprocessed waste. If a large number of heavy drums is to be shipped, a shorter and narrower version of TRUPACT-I would be preferred alternative. The Defense High-Level Waste cask is the recommended alternative system for shipping RH SS-TRU waste. 12 references, 15 figures, 22 tables.

11572 **(HEDL—7376) Conceptual design report for a remotely operated cask handling system.** Yount, J.A.; Berger, J.D. (Hanford Engineering Development Lab., Richland, WA (USA)). [nd]. Contract AC06-76FF02170. 114p. (TTC—0449). NTIS, PC A06/MF A01. Order Number DE84005300.

Recent advances in remote handling utilizing commercial robotics are conceptually applied to the problem of lowering operator cumulative dose and increasing throughput during cask handling operations in proposed nuclear waste container shipping and receiving facilities. The functional criteria for each subsystem are defined, and candidate systems are described. The report also contains a generic description of a waste receiving facility, to show possible deployment configurations for the equipment.

11573 **(HEDL-SA—2626-FP) Simulation of the dynamic response of radioactive material shipping package-railcar systems during coupling operations.** Fields, S.R. (Hanford Engineering Development Lab., Richland, WA (USA)). Oct 1983. Contract AC06-76FF02170. 24p. (CONF-840369—1). NTIS, PC A02/MF A01. Order Number DE84003791.

From 17. annual simulation symposium; Tampa, FL, USA (14 Mar 1984).

The basic equations of the computer model CARDS (Cask-Railcar Dynamic Simulator), developed for the US Nuclear Regulatory Commission to simulate the dynamic behavior of radioactive material shipping package - railcar systems, are presented. A companion model, CARRS (Cask Railcar Response Spectrum Generator), that generates system response as frequency response spectra is also presented in terms of its basic equations. 1 reference, 18 figures.

11574 **(HEDL-TME—83-32) ORIGEN2 calculations of PWR spent fuel decay heat compared with calorimeter data.** Schmittroth, F. (Hanford Engineering Development Lab., Richland, WA (USA)). Jan 1984. Contract AC06-76FF02170. 39p. NTIS, PC A03/MF A01. Order Number DE84006276.

Decay heat generation rates calculated with the ORIGEN2 code are compared with measured values for 19 spent fuel assemblies from three commercial pressurized water reactors. Input parameters of primary and secondary importance to these calculations are identified, and the sensitivity of decay heat calculations to these parameters is established. 10 references.

11575 **(NUREG/CR—2210) Technology, safety and costs of decommissioning reference independent spent fuel storage installations.** Ludwick, J.D.; Moore, E.B. (Pacific Northwest Lab., Richland, WA (USA)). Jan 1984. Contract AC06-76RL01830. 466p. NTIS, PC A20/MF A01 - GPO $9.50. Order Number DE84006094.

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Safety and cost information is developed for the conceptual decommissioning of five different types of reference independent spent fuel storage installations (ISFSIs), each of which is being given consideration for interim storage of spent nuclear fuel in the United States. These include one water basin-type ISFSI (wet) and four dry ISFSIs (drywell, silo, vault, and cask). The reference ISFSIs include all component parts necessary for the receipt, handling and storage of spent fuel in a safe and efficient manner. Three decommissioning alternatives are studied to obtain comparisons between costs (in 1981 dollars), occupational radiation doses, and potential radiation doses to the public. The alternatives considered are: DECON (immediate decontamination), SAFSTOR (safe storage followed by deferred decontamination), and ENTOMB (entombment followed by long-term surveillance).

11576 **(PNL-SA—11865) Functional design criteria for monitored retrievable storage.** Woods, W.D.; Jackson, D.S. (Parsons (Ralph M.) Co., Pasadena, CA (USA); Pacific Northwest Lab., Richland, WA (USA)). Dec 1983. Contract AC06-76RL01830. 7p. (CONF-831217—19). NTIS, PC A02/MF A01. Order Number DE84005606.

From 5. civilian radioactive waste management information meeting; Washington, DC, USA (12 Dec 1983).

A Monitored Retrievable Storage (MRS) Facility is being designed to provide a viable option for storing commercial spent fuel, high-level radioactive wastes (HLW), remote-handling transuranic waste (RH-TRU), and contact-handled transuranic waste (CH-TRU) in the event of delays in deployment of a geologic repository. It is being designed to permit safe receipt, processing, storage, monitoring and retrieval of all reasonable forms of spent fuel, HLW, RH-TRU and CH-TRU that might result from commercial nuclear activities. To satisfy the requirements of the NWPA, advanced conceptual designs will be prepared for an alternative storage concept at each of the same sites. Design was initiated in December 1983. Under the direction of PNL, the Ralph M. Parsons Company is preparing advanced conceptual designs for the designated primary storage concept at each of three reference site types and conceptual designs of the alternate storage concept at each of the same sites. Parsons will also prepare design-related reports and studies, and conduct other MRS Program related surveys and studies as requested. The design activities will include preparation of drawings; outline specifications; work breakdown structures; cost estimates; and time-phase logic network schedules for design, construction, decontamination and decommissioning. Formal design reviews are scheduled at the 30%, 70% and final comment stages in May 1984, September 1984, and January 1985 respectively. The resultant design reports including drawings, outline specifications, schedules and cost estimates will be completed in time to accompany the proposal to Congress by June 1, 1985 for construction of one or more MRS facilities. 3 tables.

11577 **(PNL-SA—11904) Alternate technologies for MRS design.** Smith, R.I.; Triplett, M.B.; Ashton, W.B.; Kelly, W.S. (Pacific Northwest Lab., Richland, WA (USA)). Jan 1984. Contract AC06-76RL01830. 16p. (CONF-840141—1). NTIS, PC A02/MF A01. Order Number DE84005887.

From INMM seminar on spent fuel storage; Washington, DC, USA (10 Jan 1984).

This paper describes the process conducted by the Pacific Northwest Laboratory (PNL) to evaluate candidate MRS concepts and to recommend the two most preferred concepts. The eight concepts studied are: metal cask (stationary and transportable); concrete cask (silo); concrete cask-in-trench; field drywell; tunnel drywell; open cycle vault; closed cycle vault; and tunnel rack vault. To achieve a more equitable comparison of the concepts, conceptual design analyses were performed for the candidate concepts using a common set of specified design requirements selected with consideration of the MRS mission. Using this normalized conceptual design information, the MRS concepts were evaluated and compared on the basis of their relative performance on seven criteria: flexibility, concept maturity, cost, environmental impacts, safety and licensing, socioeconomic impacts, and siting requirements. These seven criteria were judged to form a reasonable and complete basis for the evaluation of MRS concepts' ability to satisfy the MRS mission requirements. 5 references, 8 figures, 1 table.

11578 **(UCID—19976) Mineralogic and petrologic investigation of pre-test core samples from the spent fuel test-climax.** Ryerson, F.J.; Qualheim, B.J. (Lawrence Livermore National Lab., CA (USA)). Dec 1983. Contract W-7405-ENG-48. 64p. NTIS, PC A04/MF A01. Order Number DE84005221.

Pre-test samples obtained from just inside the perimeter of the canister emplacement holes of the Spent Fuel Test-Climax have been characterized by petrographic and microanalytical techniques. The primary quartz monzonite has undergone various degrees of hydrothermal alteration as a result of natural processes. Alteration is most apparent on primary plagioclase and biotite. The most common secondary phases on plagioclase are muscovite and calcite, while the most common secondary phases on biotite are epidote and chlorite. The major alteration zones encountered are localized along filled fractures, i.e. veins. The thickness and mineralogy of the alteration zones can be correlated with the vein mineralogy, becoming wider and more complex mineralogically when the veins contain calcite. 7 references, 10 figures, 4 tables.

0510 Marketing And Economics

REFER ALSO TO CITATION(S) 11558, 11575, 11613

11579 **(CEGB-P—7) Sizewell 'B' power station public inquiry: CEGB proof of evidence. Uranium supplies.** Townsend, M. (Central Electricity Generating Board, London (UK)). Nov 1982. 36p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83703865.

The organizational arrangements for procuring uranium supplies and the interfaces with the international uranium industry are outlined. Forecasts of WOCA (World Outside Communist Areas) uranium resources and demand are presented together with prices derived from these forecasts. CEGB requirements are reviewed against this backcloth and its existing supply arrangements, activities and long term procurement strategy are discussed.

11580 **(CONF-831217—6) Community development planning.** Gray, S.I. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). 1983. Contract AC02-83CH10140. 4p. NTIS, PC A02/MF A01. Order Number DE84005298.

From 5. civilian radioactive waste management information meeting; Washington, DC, USA (12 Dec 1983).

The focus of this paper will be methods of local community involvement in the community development planning efforts which will be required at the recommended sites. Community development planning will include capital improvement plans, housing plans, zoning changes, business development plans and other community service and fiscal plans required to meet the projected needs of new residents as a result of the repository construction and operation. This paper will present, (1) the need for community planning, (2) methods of responding to community planning needs, (3) current community planning issues to be addressed. 2 references, 1 figure.

11581 **Uranium procurement in the United States of America.** Thomas, D.C.; Krusiewski, S.V. (Resource Assessment Program, Office of Uranium Enrichment and Assessment, Department of Energy, Washington, DC (USA)). pp 425-435 of Nuclear power experience. Proceedings of an international conference held by the IAEA in Vienna, 13-17 September 1982. Vol. 3 is entitled "Nuclear fuel cycle". Vienna, Austria; International Atomic Energy Agency (1983). (CONF-820914—Vol.3; IAEA-CN—42/261).

From International conference on nuclear power experience; Vienna, Austria (13 Sep 1982).

The United States Department of Energy conducts surveys of US uranium marketing activity. The results of this year's survey compared with last year's survey indicate that delivery commitments of US uranium producers to US uranium users have decreased in the early part of this decade, but have increased in the latter part of the decade. Unfilled uranium requirements are nearly the same through 1986 in both surveys, but in the 1987-1990 period this years's unfilled requirements are lower than those reported last year. Non-US purchase commitments by US utilities are somewhat greater than those reported last year. Non-US purchase commitments by US reactor manufacturers and producers have increased significantly over the past year; about two-thirds of these purchase commitments resulted from the settlement of litigation with non-US suppliers. The attitude of US utilities as to their use of non-US uranium has remained the same over the past year. Although some of the utilities were uncertain about future non-US uranium purchases, many of them indicated that they would possibly purchase non-US uranium. Natural uranium inventories of US reactor manufacturers and utilities have increased over the past year, and now amount to about 3 years of forward coverage. The enriched uranium inventories held by these users have decreased over the past year, and now amount to less than 1 year's forward coverage.

0520 Waste Management

REFER ALSO TO CITATION(S) 11570, 11571, 11576, 11577, 11580, 11643, 11644, 11645, 11646, 11647, 11648, 11649, 11650, 11651, 11653, 11655, 11657, 11657, 11810, 11868, 12352, 12353, 12373, 12460, 12682, 12687, 12869, 12870

11582 **(AEEW-R—1534) Cement radwaste solidification studies third annual report.** Brown, D.J.; James, J.M.; Lee, D.J.; Smith, D.L.; Walker, A.T. (UKAEA Atomic Energy Establishment, Winfrith). Mar 1982. 55p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE83703912.

This report summarises cement radwaste studies carried out at AEE Winfrith during 1981 on the encapsulation of medium and low active waste in cement. During the year more emphasis has been placed on the work which is directly related to the solidification of SGHWR active sludge. Information has been obtained on the properties of 220 dm^3 drums of cemented waste. The use of cement grouts for the encapsulation of solid items has also been investigated during 1981.

11583 **(AERE-M—3255) Volatilisation of ruthenium in vitrification. Isothermal calcination studies of 'Magnox' and thermal oxide simulates.** Cains, P.W.; Hay, D.A. (UKAEA Atomic Energy Research Establishment, Harwell. Chemical Technology Div.). Dec 1982. 46p. (DOE/RW—82.085). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83703913.

Ru volatilities have been measured for the static, isothermal calcination of "Magnox" and Thermal Oxide HAL's (Highly Active Liquors) at temperatures up to 600°C. Model solutions containing Ru, HNO_3, and nitrates of important individual cations have also been investigated. Experimental design was primarily based on the requirements of rotary calcination process development. The results have been interpreted in terms of a reaction model involving competition between the simple degradation of Ru(NO) complexes to RuO_2 and oxidative decomposition to volatile species (e.g. RuO_4).

11584 **(ANL/EES-TM—235) Technological options for management of hazardous wastes from US Department of Energy facilities.** Chiu, S.; Newsom, D.; Barisas, S.; Humphrey, J.; Fradkin, L.; Surles, T. (Argonne National Lab., IL (USA)). Aug 1982. Contract W-31-109-ENG-38. 189p. NTIS, PC A09/MF A01. Order Number DE84005219.

This report provides comprehensive information on the technological options for management of hazardous wastes generated at facilities owned or operated by the US Department of Energy (DOE). These facilities annually generate a large quantity of wastes that could be deemed hazardous under the Resource Conservation and Recovery Act (RCRA). Included in these wastes are liquids or solids containing polychlorinated biphenyls, pesticides, heavy metals, waste oils, spent solvents, acids, bases, carcinogens, and numerous other pollutants. Some of these wastes consist of nonnuclear hazardous chemicals; others are mixed wastes containing radioactive materials and hazardous chemicals. Nearly 20 unit processes and disposal methods are presented in this report. They were selected on the basis of their proven utility in waste management and potential applicability at DOE sites. These technological options fall into five categories: physical processes, chemical processes, waste exchange, fixation, and ultimate disposal. The options can be employed for either resource recovery, waste detoxification, volume reduction, or perpetual storage. Detailed descriptions of each technological option are presented, including information on process performance, cost, energy and environmental considerations, waste management of applications, and potential applications at DOE sites. 131 references, 25 figures, 23 tables.

11585 **(ANL/ER-TM—83-4) Hydrogeological characterization of Back Forty area, Albany Research Center, Albany, Oregon.** Tsai, S.Y.; Smith, W.H. (Argonne National Lab., IL (USA)). Dec 1983. Contract W-31-109-ENG-38. 22p. NTIS, PC A02/MF A01. Order Number DE84005410.

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Radiological surveys were conducted to determine the potential migration of radionuclides from the waste area to the area commonly referred to as the Back Forty, located in the southern portion of the ARC site. The survey results indicated that parts of the Back Forty contain soils contaminated with uranium, thorium, and their associated decay products. A hydrogeologic characterization study was conducted at the Back Forty as part of an effort to more thoroughly assess radionuclide migration in the area. The objectives of the study were: (1) to define the soil characteristics and stratigraphy at the site, (2) to describe the general conditions of each geologic unit, and (3) to determine the direction and hydraulic gradient of areal groundwater flow. The site investigation activities included literature review of existing hydrogeological data for the Albany area, onsite borehold drilling, and measurement of groundwater levels. 7 references, 9 figures, 2 tables.

11586 **(BMI/ONWI—226) Very deep hole systems engineering studies.** (Woodward-Clyde Consultants, San Francisco, CA (USA)). Dec 1983. Contract AC06-76RL01830. 326p. NTIS, PC A15/MF A01. Order Number DE84006105.

Very Deep Hole (VDH) Waste Isolation is an alternative to or an augmentation of the mined geologic repository (MGR) for high-level radioactive waste. This planning study of the VDH concept identifies the significant problem areas associated with a VDH system, identifies and discusses attributes of the VDH concept, narrows discussions to a reference VDH system, and provides preliminary estimates of costs and schedule, and an engineering program plan for VDH system and equipment development. For the reference VDH selected for this study, the nuclear waste is emplaced and disposed in 20-in. holes that are drilled by modified rotary rigs and at depths of 20,000 feet or less. The waste is to be contained within a repository zone of the host rock having low porosity, low hydraulic gradient, and low permeability, and the repository zone is not penetrated by any aquifer. Thus, the depth of emplacement and characteristics of the host rock provide isolation that would preclude unacceptable migration of radionuclides to the biosphere. The VDH concept is credible and the reference system is technically feasible, logical, practical, and achievable by the year 2000, with slight modification of present technology. In terms of costs, the reference VDH system compares favorably with costs for MGR system disposal in salt, granite, shale, and basalt. 130 references, 39 figures, 17 tables.

11587 **(CEA-CONF—6871) Potential effects on health of radioactive waste disposal.** Sousselier, Y.; Parmentier, N. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). Jul 1983. 12p. (CONF-830710—11). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750433.

From 7. international conference of radiation research; Amsterdam, Netherlands (3 Jul 1983).

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Radioactive waste is considered to represent a potential health risk for future generation by a section of the public. The main point is that waste management must follow very strict guidelines. The radioactive waste treatment, packaging and disposal are reviewed and discussed from a safety point of view. Health physics aspects are then analysed. The major difficulties for the prediction of exposure are mainly due to the very long time periods involved. Models are studied and carried out for the prediction of radiological consequences for the transport of radioactivity through the different modules.

11588 **(CONF-801102—40) Possibility of multiple temperature maxima in geologic repositories for spent fuel from nuclear reactors.** Beyerlein, S.W.; Claiborne, H.C. (Oak Ridge National Lab., TN (USA)). 1980. Contract W-7405-ENG-26. 9p. NTIS, PC A02/MF A01. Order Number DE84004381.

From ASME winter annual meeting; Chicago, IL, USA (16 Nov 1980).

Heat transfer studies for CANDU spent fuel repositories showed that two temperature maxima at the disposal horizon could occur: one near 60 years, and another one at 13,000 years. Because CANDU spent fuels display a monotonically decreasing heat generation rate, it is not immediately obvious why such behavior occurs. This paper demonstrates that the double peak phenomenon is due to the presence of the right mixture of short- and long-lived nuclides in the fuel and the second peak disappears for repository sizes less than about 1 km^2. For larger repositories, radial and surface heat transfer reduces the magnitude of the second peak. Spent fuel from pressurized water reactors did not produce a double temperature peak even for the infinite plane source model. The differences result because of the different amounts and distribution of transuranic elements and isotopes. 8 references, 7 figures, 1 table.

11589 **(CONF-831217—4) Salt repository design approach.** Matthews, S.C. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). 1983. Contract AC02-83CH10140. 6p. NTIS, PC A02/MF A01. Order Number DE84005296.

From 5. civilian radioactive waste management information meeting; Washington, DC, USA (12 Dec 1983).

This paper presents a summary discussion of the approaches that have been and will be taken in design of repository facilities for use with disposal of radioactive wastes in salt formations. Since specific sites have yet to be identified, the discussion is at a general level, supplemented with illustrative examples where appropriate. 5 references, 1 figure.

11590 **(CONF-831217—7) Results of screening activities in salt states prior to the enactment of the Nationall Waste Policy Act.** Carbiener, W.A. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). 1983. Contract AC02-83CH10140. 4p. NTIS, PC A02/MF A01. Order Number DE84005288.

From 5. civilian radioactive waste management information meeting; Washington, DC, USA (12 Dec 1983).

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The identification of potential sites for a nuclear waste repository through screening procedures in the salt states is a well-established, deliberate process. This screening process has made it possible to carry out detailed studies of many of the most promising potential sites, and general studies of all the sites, in anticipation of the siting guidelines specified in the Nuclear Waste Policy Act. The screening work completed prior to the passage of the Act allowed the Secretary of Energy to identify seven salt sites as potentially acceptable under the provisions of Section 116(a) of the Act. These sites were formally identified by letters from Secretary Hodel to the states of Texas, Utah, Mississippi, and Louisiana on February 2, 1983. The potentially acceptable salt sites were in Deaf Smith and Swisher Counties in Texas; Davis and Lavender Canyons in the Gibson Dome location in Utah; Richton and Cypress Creek Domes in Mississippi; and Vacherie Dome in Louisiana. Further screening will include comparison of each potentially acceptable site against disqualification factors and selection of a preferred site in each of the three geohydrologic settings from those remaining, in accordance with the siting guidelines. These steps will be documented in statutory Environmental Assessments prepared for each site to be nominated for detailed characterization. 9 references.

11591 **(CONF-831217—11) Asse salt mine nuclear waste repository simulation experiments.** Coyle, A.J. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). 1983. Contract AC02-83CH10140. 10p. NTIS, PC A02/MF A01. Order Number DE84005289.

From 5. civilian radioactive waste management information meeting; Washington, DC, USA (12 Dec 1983).

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The field tests underway in Asse, Federal Republic of Germany are dicected toward the development of test plans, techniques and equipment to be used in Exploratory Shafts or At Depth Test Facilities confirmation tests. These simulated repository tests will also provide information which address the following issues: brine migration (liquid and vapor); radiation effects of gamma rays; gas generation caused by radiation and corrosion; accelerated corrosion and leaching; altered properties of salt (the effects of heat, radiation and brine); and the effects of heat and radiation on test assemblies, instruments, and various materials exposed to repository conditions. This paper is a status of the first 82 days of operation of the Asse Brine Migration Tests, which were initiated on May 25, 1983. 6 references.

11592 **(CONF-831217—13) Waste package for a repository located in salt.** Basham, S.J. Jr. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). 1983. Contract AC02-83CH10140. 5p. NTIS, PC A02/MF A01. Order Number DE84005290.

From 5. civilian radioactive waste management information meeting; Washington, DC, USA (12 Dec 1983).

This paper describes the current status of the waste package designs for salt repositories. The status of the supporting studies of environment definition, corrosion of containment materials, and leaching of waste forms is also presented. Emphasis is on the results obtained in FY 83 and the planned effort in FY 84. 8 references, 3 figures, 1 table.

11593 **(DOE/CH/10140—2) Permian Basin location recommendation report.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). Sep 1983. Contract AC02-83CH10140. 193p. NTIS, PC A09/MF A01. Order Number DE84005426.

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Candidate study areas are screened from the Palo Duro and Dalhart Basin areas using data obtained from studies to date and criteria and specifications that consider: rock geometry; rock characteristics; human intrusion potential; surface characteristics; and environmental and socioeconomic conditions. Two preferred locations are recommended from among these areas for additional characterization to identify potential National Waste Terminal Storage (NWTS) salt repository sites. One location, in northeastern Deaf Smith County and southeastern Oldham County, is underlain by two salt units that meet the adopted screening specifications. The other location, in northcentral Swisher County, is underlain by one salt unit that meets the adopted screening specifications. Both locations have several favorable features, relative to surrounding areas, and no obviously undesirable characteristics. Both lie wholly on the Southern High Plains surface, are in relatively sparsely populated areas, contain no unique land use conflicts, and comprise large enough geographic areas to provide flexibility in site selection. Data gathered to date indicate that these locations contain salt units sufficient in thickness and in depth for the safe construction and operation of the underground facilities under consideration. 93 references, 34 figures, 6 tables.

11594 **(DOE/ID/12476—T1) Data base and management support for the states. Quarterly technical progress report, October 1-December 31, 1983.** (Western Governors Regional Energy Policy Office, Denver, CO (USA)). 25 Jan 1984. Contract FG07-83ID12476. 8p. NTIS, PC A02/MF A01. Order Number DE84005710.

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This report is a summary of work carried out in fulfillment of the tasks specified in the grant and describes activities carried out from October 1, 1983, through December 31, 1983.

11595 **(DOE/LLW—27T) 1982 State-by-state assessment of low-level radioactive wastes shipped to commercial disposal sites.** (EG and G Idaho, Inc., Idaho Falls (USA); Conference of Radiation Control Program Directors, Inc. (USA)). Dec 1983. Contract AC07-76ID01570. 117p. NTIS MF A01. Order Number DE84005422.

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This report uses the volume of low-level waste reported as received at each commercial disposal site as the national baseline figure. A volume of 75,891 cubic meters of radioactive waste containing 413,898 curies of activity was reported disposed at the commercial sites in 1982. The distribution of these waste volumes by disposal site is presented in Table 1. Table 2 summarizes estimated volumes by generator categories. The total volume and curie values tabulated for each state were obtained directly from the commercial disposal site operators. The total is the sum of the volume and radioactivity by disposal site for each state. Summary information on commercial nuclear power plant wastes was obtained from semiannual waste reports submitted to the NRC in accordance with the NRC Regulatory Guide 1.21. Data reported for the calendar year 1982 were used for this report where available. When report data were not available, reactor information was obtained directly from the utility.

11596 **(DOE/SR/11036—T2) Waste package accountability and traceability.** Darr, D.G. (Allied-General Nuclear Services, Barnwell, SC (USA)). Sep 1983. Contract AC09-83SR11036. 40p. NTIS, PC A03/MF A01. Order Number DE84005618.

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A point was developed whereby a waste package accountability and traceability program could be implemented at the Barnwell Nuclear Fuel Plant (BNFP). This program was to incorporate, to the degree practical, a computerized item control and accounting system that would effectively achieve accountability and traceability. Further, a conceptual design of a waste assay facility which would support the BNFP and be integrated into the system was to be prepared. In the concept developed, the BNFP would be divided into material balance areas and control points. Wastes generated in plant operations would be assigned a unique number which included a coded identification of its origin. Before it could be removed from the control point, information which would characterize the wastes would be required to be entered into a computer. After this information was entered, the waste package identification number would be assigned by the computer. Using this package identification number, the wastes may be tracked from one area to another through computer entries. When the final waste package, which could contain one or more smaller packages, is prepared for shipment for disposal, a final unique identification number is assigned to each by the computer. Appropriate entry requirements and organization of the computer programs will allow accountability and traceability of wastes by point of origin, or by back-tracking from the final waste transport container. The conceptual drawings of a suitable waste assay facility for the BNFP operations are presented. 4 references, 8 figures, 5 tables.

11597 **(DOE/SR/11036—T4) Preparing an over-pack waste package at the reprocessor: feasibility study.** Evans, T.A. (Allied-General Nuclear Services, Barnwell, SC (USA)). 19 Aug 1983. Contract AC09-83SR11036. 18p. NTIS, PC A02/MF A01. Order Number DE84005617.

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The purpose of this study is to investigate the feasibility and cost if the waste containers are placed in the over-pack at the reprocessor instead of being placed in the over-pack at the repository. The increased weight from over-packing waste changes the entire shipping scenario. Fifty-five and 80-gallon drums could not be consolidated in the existing six pack containerization plan. The 40,000 to 50,000 pound weight per six pack would prevent using standard loading equipment and end-loading casks (TRUPACT) for contact handled waste. The Type B containers used to transport remote handled waste are limited to a maximum number of containers from: 36 fifty-five gallon drums to 18 fifty-five gallon drums (3 six packs); 28 eighty-gallon drums to 12 eighty gallon drums (2 six packs); 5 six-hundred gallon drums to 3 six-hundred gallon drums; and 2 - 4 HLW canisters (CNSI Cask Information Data). Based on these data which indicate an increased transportation cost of over two times, it is recommended that the over-packs not be placed on the waste packages at the reprocessor, but placed after shipment to the repository before burial. The cost of commercial reprocessing waste handling that is attributed to transportation is 0.196 mills/KWH, as determined by the AGNS Waste Management Economic Model. If the over-packs were added at the reprocessing plant, the transportation costs would exceed 0.4 mills/KWH. 3 references, 1 figure, 5 tables.

11598 **(DOE/SR/11036—T9) Simplified waste management economic model.** Henry, J.L. (Allied-General Nuclear Services, Barnwell, SC (USA)). Aug 1983. Contract AC09-83SR11036. 47p. NTIS, PC A03/MF A01. Order Number DE84005621.

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The simplified waste model (SIMWMM) is a simulation of the full waste model (WMEM). The WMEM was designed to both technically and economically model commercial reprocessing waste handling as waste through ultimate disposal at a repository or burial ground. SIMWMM uses a quadratic equation to approximate results obtained from runs of the full model. Numerous runs were made using the full model's variables set at a low point, midpoint, and a high point over a specified range. Using math modeling techniques, the dominant variables were selected and further runs were made using only the dominant variables to determine the response surface characteristics. Net Present Costs obtained were then used to generate the coefficients of the quadratic equations in SIMWMM. Coefficients used in each quadratic are only valid over the range which was selected for the WMEM screening studies.

11599 **(DOE/SR/11036—T17) Waste system optimization - can diameter selection.** Ashline, R.C. (Allied-General Nuclear Services, Barnwell, SC (USA)). Aug 1983. Contract AC09-83SR11036. 13p. NTIS, PC A02/MF A01. Order Number DE84005615.

The purpose of the waste system optimization study is to define in terms of cost incentives the preferred waste package for HLW which has been converted to glass at a commercial reprocessing plant. The Waste Management Economic Model (WMEM) was employed to analyze the effect of varying important design pa-

rameters on the overall net present cost of waste handling. The parameters found to have the greatest effect on the calculated overall net present cost were can diameter, repository type (salt, basalt/bentonite, or welded tuff), allowable areal heat loading, and the repository availability date. The overall net present of a waste handling option is calculated over a 20-year operating period. It includes the total capital and operating costs associated with high-level and intermediate-level liquid waste storage, liquid waste solidification, hulls storage and compaction, and general process trash handling. It also includes the cask leasing and transportation costs associated with each waste type and the waste repository disposal costs. The waste repository disposal costs used in WMEM for this analysis were obtained from Battelle Pacific Northwest Laboratories and thir RECON model. 2 figures, 2 tables.

11600 **(DPST—83-638) Bonding of radioactive contamination. III. Auger electron spectroscopic investigation.** Rankin, W.N.; Whitkop, P.G. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 23 Mar 1983. Contract AC09-76SR00001. 16p. NTIS, PC A02/MF A01. Order Number DE84005838.

The mechanisms by which radioactive contamination would be bonded to a DWPF canister surface are being investigated. Tests with low pressure water and air-injected water decontamination of radioactive specimens showed that bonding of contamination increases rapidly with postoxidation temperature. Even with the least severe temperature conditions expected on the waste glass canister, bonding is so great that decontamination cannot be affected by water-only techniques. A preoxidation film increased rather than decreased bonding. This memorandum describes detailed surface analyses of coupons simulating DWPF canister surfaces. Based on this examination we conclude: contamination will be dispersed throughout the oxide film on DWPF canisters. Contamination is concentrated at the surface, decreasing farther into the oxide film; some samples contain sludge contamination at the steel/oxide interface. This was not the case for semi-volatile (Cs_2O) contamination; in samples with contamination at the steel/oxide interface, at least 80% of the contamination is usually in the oxide layer; no difference in contamination dispersion between preoxidized and non-preoxidized samples was found; and postoxidation atmosphere had no effect on the contamination dispersion within the oxide layer. 6 references, 9 figures.

11601 **(DPST—83-765) Bonding of radioactive contamination. IV. Effect of surface finish.** Rankin, W.N. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 22 Aug 1983. Contract AC09-76SR00001. 11p. NTIS, PC A02/MF A01. Order Number DE84005837.

The mechanisms by which radioactive contamination would be bonded to a DWPF canister are being investigated. Previous investigations in this series have examined the effects of temperature, oxidation before contamination, and atmosphere composition control on the bonding of contamination. This memorandum describes the results of tests to determine the effect of special surface finishes on the bonding of contamination to waste glass canisters. Surface pretreatments which produce smoother canister surfaces actually cause radioactive contamination to be more tightly bonded to the metal surface than on an untreated surface. Based on the results of these tests it is recommended that the canister surface finish be specified as having a bright cold rolled mill finish equivalent to ASTM No. 2B. 7 references, 3 figures, 3 tables.

11602 **(DPST—83-939) Evaluation of high pressure Freon decontamination. I. Preliminary tests.** Rankin, W.N. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 31 Oct 1983. Contract AC09-76SR00001. 17p. NTIS, PC A02/MF A01. Order Number DE84005839.

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High-pressure Freon blasting techniques are being evaluated for applications involving the removal of non-adherent radioactive particulate contamination at SRP. Very little waste is generated by this technique because the used Freon can be easily distilled and reused. One of the principle advantages of this technique is that decontaminated electrical equipment can be returned to service immediately without drying, unlike high-pressure water blasting techniques. Preliminary scoutin tests evaluating high-pressure Freon blasting for decontamination at SRP were carried out at Quadrex Co., Oak Ridge, TN, October 12 and 13. DWPF-type contamination (raw sludge plus volatiles) and separations area-type contamination (diluted boiling point (47.6°C) allow it to rapidly separate from higher boiling contaminants via distillation with filtration to remove particulate material, and distillation with condensation, the solvent may be recovered for indefinite reuse while reducing the radioactive waste to a minimum. 3 references, 5 figures, 6 tables.

11603 **(HEDL-TC—2353-2) Test plan for spent fuel cladding containment credit tests.** Wilson, C.N. (Hanford Engineering Development Lab., Richland, WA (USA)). Nov 1983. Contract AC06-76FF02170. 26p. NTIS, PC A03/MF A01. Order Number DE84005299.

Lawrence Livermore National Laboratory has chosen Westinghouse Hanford Company as a subcontractor to assist them in determining the requirements for successful disposal of spent fuel rods in the proposed Nevada Test Site repository. An initial scoping test, with the objective of determining whether or not the cladding of a breached fuel rod can be given any credit as an effective barrier to radionuclide release, is described in this test plan. 8 references, 2 figures, 4 tables.

11604 **(INIS-mf—8205) Mechanical and chemical decontamination of surfaces.** Kienhoefer, M. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.)). (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Schule fuer Kerntechnik). 1982. 19p. (CONF-8209134—32). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704227.

From IAEA interregional training course on waste management in nuclear facilities; Karlsruhe, F.R. Germany (6 Sep 1982).

Decontamination does not mean more than a special technique of cleaning surfaces by methods well known in the industry. The main difference consists in the facts that more than just the visible dirt is to be removed and that radioactive contamination cannot be seen. Especially, intensive mechanical and chemical carry-off methods are applied to attack the surfaces. In order to minimize damages caused to the surfaces, the decontamination method is to adapt to the material and the required degree of decontamination. The various methods, their advantages and disadvantages are described, and the best known chemical solutions are shown. (orig./RW).

11605 **(LBL—16578) Techniques for measuring the vertical hydraulic conductivity of flood basalts at the Basalt Waste Isolation Project site.** Javandel, I. (Lawrence Berkeley Lab., CA (USA)). Jun 1983. Contract AC03-76SF00098. 72p. NTIS, PC A04/MF A01. Order Number DE84006262.

A regional model that can predict groundwater movement through the reference repository location and surrounding area is essential to assessing the site suitability for a nuclear waste repository. During the last two decades, several models have been developed to handle complicated flow patterns through complex geologic materials. The basic problem, however, is obtaining the data base needed to apply these models. The hydrological data needed include the spatial distribution of effective porosity, the hydraulic conductivity tensor and its variation in space, values of specific storage, the hydraulic head distribution, and the fluid properties. In this report, we discuss conventional methods of obtaining vertical hydraulic conductivity and examine their applicability to the BWIP site. 39 references, 12 figures, 4 tables.

11606 **(NUREG/CR—3018) Characterization of the Class B stable radioactive waste packages of the New England Nuclear Corporation.** Gause, E.P.; Veakis, E.; Smalley, J. (Brookhaven National Lab., Upton, NY (USA)). Dec 1983. Contract AC02-76CH00016. 68p. (BNL-NUREG—51607). NTIS, PC A04/MF A01 - GPO $4.50. Order Number DE84005653.

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The New England Nuclear Corporation (NEN) produces, in addition to other products, H-3 and C-14 labeled chemicals. The preparation of these radioactive compounds annually generates approximately 60,000 Ci of tritiated organic waste (largely composed

of alcohols) and 60,000 Ci of tritium (H-3) gaseous waste annually. Both of these major waste streams are disposed of by commercial shallow land burial. The characterization and evaluation of NEN waste packages which contain amounts of activity of isotopes that fall within proposed 10 CFR Part 61 Class B Stable limits are the primary subject of this report. The cooperation of NEN prior to the enactment of 10 CFR Part 61 enabled the NRC to examine the achievability of the proposed 10 CFR Part 61 criteria. Several types of NEN waste packages are characterized. One type (low-activity) contains less than 20 Ci of H-3 and/or C-14 in the form of absorbed organic or solidified aqueous liquids. The other type (high-activity) contains more than 20 Ci and less than 1000 Ci of H-3 in the form of gas or absorbed organic liquid. 62 references, 4 figures, 10 tables.

11607 **(NUREG/CR—3111/2) Assessment of the proposed rule (10CFR60) for disposal of high-level radioactive wastes in geologic repositories. Volume II. Appendices.** (Sandia National Labs., Albuquerque, NM (USA)). Nov 1983. Contract AC04-76DP00789. 249p. (SAND—82-2969/2). NTIS, PC A11/MF A01 - GPO. Order Number DE84004269.

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The Nuclear Regulatory Commission (NRC) has proposed a Rule (10CFR60) which specifies criteria for disposal of high-level radioactive wastes (HLW) in geologic repositories. The Sandia National Laboratories (SNLA) was funded by the NRC to provide information that NRC could use: to evaluate the rationale for the technical requirements in the Rule, to respond to public comments on the proposed Rule, and to analyze the benefits of alternative criteria for the final Rule. Detailed analyses of the three numerical criteria pertaining to a containment period, a controlled release rate, and a pre-waste emplacement ground-water travel time have been reported in Volume I. A panel of experts was formed to address and debate the issues relating to the requirements contained in the proposed Rule. A set of questions, prepared by the NRC, was posed to the panel as a whole and a number of panel meetings were held to address those questions in a general manner. In addition, each non-SNLA panel member was assigned one (or more) specific topic(s) according to his area of expertise for a more detailed investigation. This document, Volume II, is a compilation of topical contractor reports submitted by the various panel members. The topical reports that deal with the numerical criteria (Appendices I, J, and K) also contain discussions on the interpretation, achievability, and assessment of compliance with respect to the criterion being investigated. Many of the recommendations contained in Volume I are based on these topical reports.

11608 **(NUREG/CR—3143-Vol.1-Exec.Summ.) Indirect rock mass investigations for optimizing borehole drilling programs. Volume 1. Executive summary.** Glass, C.E. (Arizona Univ., Tucson (USA). Dept. of Mining and Geological Engineering). Oct 1983. 29p. NTIS, PC A03/MF A01 - GPO $3.50. Order Number DE84900699.

Waves, by way of their speed of propagation, interaction with boundaries, and energy loss mechanisms, yield information related to the physical properties of media through which they pass. Measurements of wave characteristics at the ground surface or in boreholes, therefore, provide a means by which to ascertain the geologic properties and internal geometry of a rock mass. The resolution of wave propagation techniques is shown to be theoretically limitless, depending only on instrument sensitivity and noise. Because of this, we recommend using techniques that can be applied in immediate proximity to candidate rock masses. Geotomography and wavefront reconstruction (holography) are considered two promising techniques for site investigation and characterization. Of the two, geotomography is treated in detail because of its lower sensitivity to noise, and ease of implementation. Algorithms are presented for both ray-optic geotomography and diffusion geotomography. Although the diffusion geotomography algorithm is more general and more satisfying from a physics standpoint, for large numbers of measurements (typical field situations) the mathematics of the inverse problem implicitly requires source frequencies that approach ray optic behavior. The ultimate conclusion is that, regardless of the algorithm used, one should probe using the highest source frequencies possible for given site conditions.

11609 **(NUREG/CR—3510) Field testing of fugitive dust control techniques at a uranium mill tailings pile - 1982 Field Test, Gas Hills, Wyoming.** Elmore, M.R.; Hartley, J.N. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1983. Contract AC06-76RL01830. 75p. (PNL—4798). NTIS, PC A04/MF A01 - GPO $4.50. Order Number DE84005657.

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A field test was conducted on a uranium tailings pile to evaluate the effectiveness of 15 chemical stabilizers for control of fugitive dust from uranium mill tailings. A tailings pile at the Federal American Partners (FAP) Uranium Mill, Gas Hills, Wyoming, was used for the field test. Preliminary laboratory tests using a wing tunnel were conducted to select the more promising stabilizers for field testing. Fourteen of the chemical stabilizers were applied with a field spray system pulled behind a tractor; one--Hydro Mulch--was applied with a hydroseeder. A portable weather station and data logger were installed to record the weather conditions at the test site. After 1 year of monitoring (including three site visits), all of the stabilizers have degraded to some degree; but those applied at the manufacturers' recommended rate are still somewhat effective in reducing fugitive emissions. The following synthetic polymer emulsions appear to be the more effective stabilizers: Wallpol 40-133 from Reichold Chemicals, SP-400 from Johnson and March Corporation, and CPB-12 from Wen Don Corporation. Installed costs for the test plots ranged from $8400 to $11,300/ha; this range results from differences in stabilizer costs. Large-scale stabilization costs of the test materials are expected to range from $680 to $3600/ha based on FAP experience. Evaluation of the chemical stabilizers will continue for approximately 1 year. 2 references, 33 figures, 22 tables.

11610 **(NUREG/CR—3586) Parameters and variables appearing in repository design models.** Curtis, R.H.; Wart, R.J. (Acres American, Inc., Buffalo, NY). Dec 1983. 178p. NTIS, PC A09/MF A01 - GPO $6.00. Order Number DE84900668.

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This report defines the parameters and variables appearing in repository design models and presents typical values and ranges of values of each. Areas covered by this report include thermal, geomechanical, and coupled stress and flow analyses in rock. Particular emphasis is given to conductivity, radiation, and convection parameters for thermal analysis and elastic constants, failure criteria, creep laws, and joint properties for geomechanical analysis. The data in this report were compiled to help guide the selection of values of parameters and variables to be used in code benchmarking. 102 references, 33 figures, 51 tables.

11611 **(NUREG/CR—3594) Axial strength of cement borehole plugs in granite and basalt. Topical report on rock mass sealing.** Stormont, J.C.; Daemen, J.J.K. (Arizona Univ., Tucson (USA). Dept. of Mining and Geological Engineering). Dec 1983. 188p. NTIS, PC A09/MF A01 - GPO $6.00. Order Number DE84900654.

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This report describes experimental and theoretical studies of the axial strength of cement plugs installed in boreholes drilled coaxially in granite and in basalt cylinders. Experimental work has consisted of loading the cement plugs to failure while measuring loads and displacements. Such tests have been performed on borehole plugs with a diameter and a length ranging from 2.5 cm to 10 cm. Results from over one hundred experiments show that the strength is high, sufficient for anticipated loads at repository depths, but very variable, complicating the design of very short plugs. Significant residual strength (thirty to fifty percent of the peak strength) is observed. A frictional model of the interface shear strength, tau = c + σ(tan phi), in combination with the assumption of an exponential shear stress distribution or plug-rock load transfer, provides the simplest realistic model for plug strength characterization. The integrated strength thus calculated compares moderately well with experimental results. An extensive review is given of more sophisticated analysis procedures that should be of value for general plug design applications. Generic analyses and their implications for plug performance are included. Variability of experimental results complicates the assessment of their direct detailed applicability. 115 references, 70 figures, 19 tables.

11612 **(PB—84-102128) Vaporization of simulated nuclear waste glass.** Hastie, J.W.; Plante, E.R.; Bonnell, D.W. (National Bureau of Standards, Washington, DC (USA)). Jun 1983. 71p. (NBSIR—83-2731). NTIS, PC A04/MF A01.

Industrial development of nuclear waste glass processing requires basic data on glass vaporization thermodynamics. Detailed mass spectrometric experiments and thermodynamic estimates have been made for vaporization of a nonradioactive borosilicate glass containing representative nuclear waste isotopes. Alkali metaborates were observed to be the dominant vapor species and their partial pressures indicate significant vapor transport under likely process conditions. The results indicate the following order of significance for vapor transport of radionuclide species, Cs about equal to Re (about equal to Tc) > Ru >> Sr.

11613 **(PNL—4640) US Army facility for the consolidation of low-level radioactive waste.** Stein, S.L.; Tanner, J.E.; Murphy, B.L.; Gillings, J.C.; Hadley, R.T.; Lyso, O.M.; Gilchrist, R.L.; Murphy, D.W. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1983. Contract AC06-76RL01830. 107p. NTIS, PC A06/MF A01. Order Number DE84005334.

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A preliminary study of a waste consolidation facility for the Department of the Army's low-level radioactive waste was carried out to determine a possible site and perform a cost-benefit analysis. Four sites were assessed as possible locations for such a facility, using predetermined site selection criteria. To assist in the selection of a site, an evaluation of environmental issues was included as part of each site review. In addition, a preliminary design for a waste consolidation facility was developed, and facilities at each site were reviewed for their availability and suitability for this purpose. Currently available processes for volume reduction, as well as processes still under development, were then investigated, and the support and handling equipment and the staff needed for the safe operation of a waste consolidation facility were studied. Using current costs for the transportation and burial of low-level waste, a cost comparison was then made between waste disposal with and without the utilization of volume reduction. Finally, regulations that could affect the operation of a waste consolidation facility were identified and their impact was assessed. 11 references, 5 figures, 16 tables.

11614 **(RHO-BW-SA—327P) Site screening process and identification of candidate repository horizons on the Hanford site.** Brown, D.J.; Long, P.E. (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). Dec 1983. Contract AC06-77RL01030. 15p. (CONF-831217—14). NTIS, PC A02/MF A01. Order Number DE84006037.

From 5. civilian radioactive waste management information meeting; Washington, DC, USA (12 Dec 1983).

This paper reviews the basis for the selection of the reference repository location, the site for the principal borehole and exploratory shaft, and the selection of the preferred candidate repository horizon. Based on the currently recognized differences among the candidate repository horizons, application of expert judgment clearly identifies the Cohassett as the preferred candidate repository horizon. This result corroborated the result obtained using the decision analysis approach. 20 references, 12 figures, 1 table.

11615 **(RHO-BW-SA—328P) Planned site characterization for the Basalt Waste Isolation Project.** Hunt, G.S.; Fecht, K.R. (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). Dec 1983. Contract AC06-77RL01030. 7p. (CONF-831217—18). NTIS, PC A02/MF A01. Order Number DE84006034.

From 5. civilian radioactive waste management information meeting; Washington, DC, USA (12 Dec 1983).

This paper summarizes fiscal years 1984 and 1985 site characterization for planned geohydrologic activities at the Basalt Waste Isolation Project. Summaries are presented on surficial geologic studies, resource potential evaluation, tectonic studies, structural geologic studies, host rock studies, hydrochemical studies, hydraulic parameter studies, and conceptual groundwater flow model. 5 references, 5 figures.

11616 **(RHO-BW-SA—330P) Waste packages for a repository located in basalt.** Smith, M.J.; Barney, G.S.; Moore, E.L. (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). Dec 1983. Contract AC06-77RL01030. 12p. (CONF-831217—16). NTIS, PC A02/MF A01. Order Number DE84006040.

From 5. civilian radioactive waste management information meeting; Washington, DC, USA (12 Dec 1983).

This paper presents the status of the BWIP waste package materials testing, modeling, and design activities and plans for continuing these activities through FY 1984. The first in a series of design activities leading to the final design of waste packages that will reliably meet federal performance criteria has been completed. These activities have led to the development of waste package conceptual designs for commercial and defense high-level waste (borosilicate glass) and spent fuel rods. Planned engineering studies, together with an improved materials data base, will provide the necessry information for the preparation of waste package advanced conceptual design requirements during FY 1984. 12 references, 5 tables.

11617 **(RHO-BW-SA—332-P) Principal elements of the Basalt Waste Isolation Project performance assessment studies.** Baca, R.G.; Wilde, R.T. (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). Dec 1983. Contract AC06-77RL01030. 9p. (CONF-831217—17). NTIS, PC A02/MF A01. Order Number DE84006041.

From 5. civilian radioactive waste management information meeting; Washington, DC, USA (12 Dec 1983).

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In this paper, three of the principal elements of the Basalt Waste Isolation Project (BWIP) performance assessment studies are focused on: (1) development of a methodology for probabilistic risk assessment, (2) performance analyses of repository subsystems, and (3) selection and ranking of disruptive event scenarios. Other elements of the BWIP performance assessment studies are briefly outlined. 12 references, 5 figures.

11618 **(RISO-M—2368) Exposure rates from concrete covered cylindrical units containing radioactive waste.** Hedemann Jensen, P. (Risoe National Lab., Roskilde (Denmark)). Mar 1983. 36p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83703914.

Exposure rates from cylindrical waste units containing the nuclides ^{60}Co, ^{134}Cs and ^{137}Cs homogeneously mixed in a solidification product have been calculated. Analyses have been made for single drums and for two disposal geometries, one with the units placed below ground near the surface in a circular geometry, and one with the units placed on the ground in a pile behind a concrete wall. Due to self-shielding of the units, the exposure rate from the two geometries will be a factor of only 10 - 20 higher than from a single unit, even without soil or wall shielding. With one meter of soil above the circular pile below ground, a reduction factor of 5.10^3 to 5.10^4 can be achieved, depending on the nuclide considered. Placing a one-meter concrete wall in front of the drum pile on the ground gives rise to a reduction factor in the range of 5.10^5 to 2.10^7.

11619 **(SAAS—305) Interaction between solidified radioactive wastes and rock salt due to hygroscopicity.** Koerner, W. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). 1983. 32p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83704360.

Laboratory experiments have been carried out to study the release of water from solidified radioactive waste in the presence of NaCl. Knowledge of this process is important for assessing the suitability of rock salt caverns for the container-free disposal of liquid waste after in-situ solidification by inorganic binders. The solidification products examined were prepared by reaction of borate-containing low- and intermediate-level waste concentrates with cement or fly ash from lignite-fired power plants. From the results obtained conclusions have been drawn with a view to minimizing the dissolution of NaCl and leaching of radionuclides during terminal storage of such wastes in rock-salt formations.

11620 (SAND—83-1451C) NNWSI performance assessment considerations. Tyler, L.D.; Peters, R.R.; Hayden, N.K.; Johnstone, J.K.; Sinnock, S. (Sandia National Labs., Albuquerque, NM (USA)). Nov 1983. Contract AC04-76DP00789. 8p. (CONF-831174—63). NTIS, PC A02/MF A01. Order Number DE84005524.

From Materials Research Society annual meeting; Boston, MA, USA (14 Nov 1983).

The Nevada Nuclear Waste Storage Investigations (NNWSI) project includes a Performance Assessment task to evaluate the containment and isolation potential for a nuclear waste repository at Yucca Mountain in southern Nevada. This task includes calculations of the rates and concentrations at which radionuclides might be released and transported from the repository and will predict their consequences if they enter the human environment. Among the major tasks required for these calculations will be the development of models for water flow and nuclide transport under unsaturated conditions and in fractured hard rock. The program must also quantify the uncertainties associated with the results of the calculations. The performance assessment will provide evaluations needed for making major decisions as the US Department of Energy seeks a site for a repository. An evaluation will be part of the environmental assessments prepared to accompany the potential nomination of the site. If the Yucca mountain site is selected for characterization and development as a repository, the assessments will be required for an environmental impact statement, a safety analysis report, and other documents. This program has been divided into five tasks. Collectively they will provide the performance assessments needed for the NNWSI Project. 1 figure, 1 table.

11621 (SAND—83-1516C) Waste package materials field test in S.E. New Mexico salt. Molecke, M.A.; Torres, T.M. (Sandia National Labs., Albuquerque, NM (USA)). Nov 1983. Contract AC04-76DP00789. 9p. (CONF-831174—65). NTIS, PC A02/MF A01. Order Number DE84005514.

From Materials Research Society annual meeting; Boston, MA, USA (14 Nov 1983).

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A six-part, waste package materials field test was conducted in a halite horizon of a potash mine in southeastern New Mexico. The primary purposes of this test were to evaluate the thermophysical and geochemical performance of candidate HLW-package backfill materials emplaced in rock salt and the corrosion behavior of candidate waste canister or overpack alloys. This field test series also served as a precursor to forthcoming Waste Isolation Pilot Plant (WIPP) in-situ waste package performance experiments on simulated defense high-level waste packages, serving to develop applicable testing, instrumentation, and sampling techniques. The backfill materials tested (individually, in one- to five-month tests) were: low-density bentonite clay; low-density bentonite (70 wt %)-silica sand (30 wt %) mixtures, both dry and brine-injected; high-density bentonite-sand annular compacts; trapped air; and finely-crushed WIPP salt. The in-situ measured thermal conductivities (at a maximum canister-heater surface temperature of 150° or 250°C) for the backfills ranged from 0.25 W/mK for pure bentonite to about 1.25 W/mK for the high-density bentonite-sand. No significant backfill material degradation products were detected in post-test analyses. No appreciable corrosion of the titanium-, nickel-, or iron-based alloys embedded in the hot backfill was found; potentially significant pitting corrosion of 2-1/4 Cr-1 Mo steel and copper was detected. 11 references, 1 table.

11622 (SKBF-KBS-TR—82-08(Pt.1)) Diffusion in the matrix of granitic rock. Field test in the Stripa mine. Part 1. Birgersson, L.; Neretnieks, I. (Svensk Kaernbraenslefoersoerjning AB, Stockholm). Jul 1982. 37p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83703915.

A migration experiment in the rock matrix is presented. The experiment has been carried out in undisturbed rock, that is rock under its natural stress environment. Since the experiment was performed at the 360 m-level (in the Stripa mine), the rock had nearly the same conditions as the rock surrounding a nuclear waste storage. The results show that all three tracers (Uranine, Cr-EDTA and I^-) have passed the disturbed zone from the injection hole and migrated into undisturbed rock. At the distance of 11 cm from the injection hole 5-10 percent of the injection concentration was found. The results also indicate that the tracers have passed through fissure filling material. These results indicate that it is possible for tracers (and therefore radionuclides) to migrate from a fissure, through fissure filling material, and into the undisturbed rock matrix.

11623 (SKBF-KBS-TR—82-18) Radiolysis of ground water from spent fuel. Christensen, H.; Bjergbakke, E. (Svensk Kaernbraenslefoersoerjning AB, Stockholm). Nov 1982. 28p. (STUDSVIK-NW—82-364). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83704361.

The effects of the radiolysis of water exposed to mixed alpha- and beta-radiation originating from spent fuel have been calculated. The water is assumed to have penetrated the copper canister and fuel cladding, and then to exist as a 30 μm thin surface film on the fuel pellets. The combined effects of alpha and beta radiation, and the presence of iron in the water have been found to be important parameters. The beta-radiation will lower the yield of hydrogen, and so will the presence of low concentrations of iron ions. The most likely conditions for water exposed fuel give rise to a total production of 1 mol H_2 per m^2 fuel surface after 1 million years. A stoichiometric amount of oxygen is also formed. The presence of an iron buffer, with a continuous supply of Fe^{2+} ions to the irradiated water phase increases the yield of hydrogen. After 1 million years the total hydrogen production is 70 mol per m^2 exposed fuel surface. A stoichiometric amount of Fe^{3+} is also formed. If pure water is irradiated (i.e. iron is excluded) the yields of hydrogen and oxygen produced are high. The integrated production of hydrogen after 1 million years is 200 mol per m^2 exposed fuel surface. A stoichiometric amound ot oxygen is also formed.

11624 (SKBF-KBS-TR—82-21) Sorption of actinides in granitic rock. Allard, B. (Svensk Kaernbraenslefoersoerjning AB, Stockholm). Nov 1982. 65p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE83704363.

The sorption of americium (III), neptunium(V) and plutonium on geologic media under oxic conditions has been measured by a batch technique. The aqueous phase was a synthetic groundwater or 4M NaCl solution. The solid phase was a pure mineral, representative of igneous rocks, or granite. Altogether 40 different minerals and rocks were used. The effects of pH and the ionic strength of the aqueous phase as well as of the cation exchange capacity and the surface/mass ratio of the solid sorbent are discussed. Empirical equations giving the distribution coefficient as a function of pH in the environmental pH-range 7-9 are suggested. Some observations and conclusions concerning sorption mechanisms are given.

11625 (SKBF-KBS-TR—82-23) Analysis of groundwater from deep boreholes in Kraakemaala, Sternoe and Finnsjoen. Laurent, S. (Svensk Kaernbraenslefoersoerjning AB, Stockholm). Dec 1982. 44p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83704364.

Groundwater from deep boreholes in granitic rock at three different sites in Sweden - Finnsjoen, Kraakemaala and Sternoe - has been sampled and analysed. A total of ten different boreholes have been sampled; one at Kraakemaala, two at Sternoe and seven at Finnsjoen. In general four levels per hole containing waterbearing fractures have been selected. Prior to sampling, a water-bearing level is isolated between packer sleeves. The deepest levels are down to about 500 m. The sampling was carried out by the Geological Survey of Sweden and a number of laboratories have participated in the water analyses. The present report is a presentation of the results of the groundwater analyses. The reliability of the results is discussed, but there is no evaluation in relation to geology and hydrogeology. This report will present the basic results from the groundwater analyses to be further evaluated by experts in different fields.

11626 (SKBF-KBS-TR—82-25) PH-buffering effects of the CO_2-CO_3^{2-} system in deep groundwaters. Allard, B. (Svensk Kaernbraenslefoersoerjning AB, Stockholm). Dec 1982. 20p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704365.

Equilibria in the system H_2O-CO_2-$CaCO_3$(s) are discussed, and data from some deep granitic groundwaters are summarized. For most waters pH would be in the range 7-9 and the total car-

bonate concentration in the range 30-400 mg/l (more often 90-275 mg/l). The observed field data represent reasonably well closed water systems with fixed total carbonate concentrations. The carbonate concentration (CO_3^{2-}) can be estimated from log [CO_3^{2-}] = 0.76pH-10.83+0.08, which would represent about 50% of all the observed concentration/pH-data (for the waters with the highest carbonate concentrations).

11627 **(SKBF-KBS-TR—82-26) Mobilities of radionuclides in fresh and fractured crystalline rock.** Torstenfelt, B.; Ittner, T.; Allard, B.; Andersson, K.; Olofsson, U. (Svensk Kaernbraenslefoersoerjning AB, Stockholm). Dec 1982. 29p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83704366.

Sorption and migration of technetium, cesium and americium on fracture surfaces and fresh surfaces of granites taken from drilling cores from the Finnsjoen and Studsvik areas and the Stripa mine are reported. The three elements were used as reference elements with different chemistry and behaviour in water; under the conditions used in the experiments technetium exists as the heptavalent TcO_4^--ion, cesium as the non-complexed monovalent cation Cs^+ and americium as the strongly hydrolysed Am(OH)super (3-x) (x=1-4). The waters used were synthetic groundwaters representative of waters from the drilling holes. After the exposure of the fracture samples to spiked groundwater solutions for a period of three up to six months the penetration depths and concentration profiles were analysed and autoradiographs of cesium and americium distribution vs depth were taken. The sorption of technetium was found to be negligible. The transport of TcO_4^- depends on accessibility to fractures and micro-fissures in the rock. Cesium is sorbed through an ion-exchange process. Migration of cesium depends not only on the transport in water into fractures and microfissures, but also on migration through mineral veins with a high CEC. Americium is strongly sorbed on most solid surfaces and did not migrate significantly during the contact time of three months. The diffusivity in granite was found to be around 10^{-13} m^2/s for cesium; preliminary values for technetium and americium were $10^{-12} m^2/s$ and less than $10^{-16} m^2/s$, respectively.

11628 **(UCRL—53449) Containment barrier metals for high-level waste packages in a Tuff repository.** Russell, E.W.; McCright, R.D.; O'Neal, W.C. (Lawrence Livermore National Lab., CA (USA)). 12 Oct 1983. Contract W-7405-ENG-48. 27p. NTIS, PC A03/MF A01. Order Number DE84005629.

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The Nevada Nuclear Waste Storage Investigations (NNWSI) Waste Package project is part of the US Department of Energy's Civilian Radioactive Waste Management (CRWM) Program. The NNWSI project is working towards the development of multibarriered packages for the disposal of spent fuel and high-level waste in tuff in the unsaturated zone at Yucca Mountain at the Nevada Test Site (NTS). The final engineered barrier system design may be composed of a waste form, canister, overpack, borehole liner, packing, and the near field host rock, or some combination thereof. Lawrence Livermore National Laboratory's (LLNL) role is to design, model, and test the waste package subsystem for the tuff repository. At the present stage of development of the nuclear waste management program at LLNL, the detailed requirements for the waste package design are not yet firmly established. In spite of these uncertainties as to the detailed package requirements, we have begun the conceptual design stage. By conceptual design, we mean design based on our best assessment of present and future regulatory requirements. We anticipate that changes will occur as the detailed requirements for waste package design are finalized. 17 references, 4 figures, 10 tables.

11629 **(UCRL—89820) Thermal modeling of nuclear waste package designs for disposal in tuff.** Hockman, J.N.; O'Neal, W.C. (Lawrence Livermore National Lab., CA (USA)). Sep 1983. Contract W-7405-ENG-48. 18p. (CONF-840307—1). NTIS, PC A02/MF A01. Order Number DE84001431.

From Waste management '84; Tucson, AZ, USA (11 Mar 1984).

Lawrence Livermore National Laboratory is involved in the design and testing of high-level nuclear waste packages. Many of the aspects of waste package design and testing (e.g., corrosion and leaching) depend in part on the temperature history of the emplaced packages. This paper discusses thermal modeling and analysis of various emplaced waste package conceptual designs including the models used, the assumptions and approximations made, and the results obtained. 6 references, 6 figures, 3 tables.

11630 **(UCRL—90045) Performance testing of waste forms in a tuff environment.** Oversby, V.M. (Lawrence Livermore National Lab., CA (USA)). Nov 1983. Contract W-7405-ENG-48. 24p. (CONF-831217—3). NTIS, PC A02/MF A01. Order Number DE84005134.

From 5. civilian radioactive waste management information meeting; Washington, DC, USA (12 Dec 1983).

This paper describes experimental work conducted to establish the chemical composition of water which will have reacted with Topopah Spring Member tuff prior to contact with waste packages. The experimental program to determine the behavior of spent fuel and borosilicate glass in the presence of this water is then described. Preliminary results of experiments using spent fuel segments with defects in the Zircaloy cladding are presented. Some results from parametric testing of a borosilicate glass with tuff and 304L stainless steel are also discussed. Experiments conducted using Topopah Spring tuff and J-13 well water have been conducted to provide an estimate of the post-emplacement environment for waste packages in a repository at Yucca Mountain. The results show that emplacement of waste packages should cause only small changes in the water chemistry and rock mineralogy. The changes in environment should not have any detrimental effects on the performance of metal barriers or waste forms. The NNWSI waste form testing program has provided preliminary results related to the release rate of radionuclides from the waste package. Those results indicate that release rates from both spent fuel and borosilicate glass should be below 1 part in 10^5 per year. Future testing will be directed toward making release rate testing more closely relevant to site specific conditions. 17 references, 7 figures.

11631 **(UJV—6387-CH) $Na_2O.B_2O_3$-Al_2O_3-P_2O_5 system as a medium for vitrification of nuclear power plant wastes. Simplex experiment and melting equipment test.** Stejskal, J.; Voldan, J.; Vojtech, O. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)). Sep 1982. 34p. (In Czech). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83704359.

Laboratory experiments have shown that in the studied system $3Na_2O.B_2O_3$-Al_2O_3-P_2O_5 in the area of the delineated simplex triangle it is possible to obtain glasses which are very easily melted at temperatures of approximately 1100 degC. These glasses have only a slight tendency to crystallization and a high dilatability, especially in the region of transformation. Also studied was the hydrolytical and chemical resistance of different glass samples. The pilot plant experiment verified the possibility of the fixation of radioactive wastes in material based on sodium borophosphates.

11632 **Development of the geologic waste disposal programme in the United States of America.** Coffman, F.E.; Ballard, W.W. (Department of Energy, Washington, DC (USA)); Carbiener, W.A. (Battelle Columbus Labs., OH (USA)). pp 181-199 of Nuclear power experience. Proceedings of an international conference held by the IAEA in Vienna, 13-17 September 1982. Vol. 3 is entitled "Nuclear fuel cycle". Vienna, Austria; International Atomic Energy Agency (1983). (CONF-820914—Vol.3; IAEA-CN—42/265).

From International conference on nuclear power experience; Vienna, Austria (13 Sep 1982).

Although alternative concepts are being studied as future options, over at least the next few decades the United States of America is committed to the disposal of commercially generated high-level and transuranic nuclear waste (HLW and TRU) in mined geologic repositories. A 10,000-year minimum isolation period is sought. Responsibility for the management and disposal of United States nuclear waste, in accordance with standards and regulations established, respectively, by the Environmental Protection Agency

(EPA) and the Nuclear Regulatory Commission (NRC), resides with the Department of Energy (DOE). The DOE National Waste Terminal Storage (NWTS) Program has been implemented to provide the facilities and develop the requisite technology for the disposal of HLW and TRU. The NWTS Program is highly structured, adequately funded, and realistically scheduled. The timely realization of its objectives is basic to the furtherance of the new national energy policy being defined by President Reagan and the United States Congress. The first NWTS repository is scheduled to be operational as early as 1998. The host-rock formation, selected on the basis of the results of at-depth investigations via exploratory shafts to be sunk in 1983-1985 at three potential sites previously extensively characterized by surface techniques, will be either basalt, volcanic tuff, or domed or bedded salt. Selection of one site in these formations will not necessarily disqualify others. Also, screening studies of granitic formations in the United States for the siting of later, regionally located repositories are currently being conducted. Each NWTS repository will be licensed by the NRC. The first application for a construction authorization will probably be submitted in 1988. The application will be submitted for a site to be selected in 1987.

11633 **NRC regulatory requirements for disposal of high-level radioactive waste in geologic repositories.** Comella, P.A. (U.S. Nuclear Regulatory Commission, Washington, DC). *Proceedings, Intersociety Energy Conversion Engineering Conference;* 3: 1326-1327(Aug 1982). (CONF-820814—).

From 17. Intersociety Energy Conversion Engineering conference; Los Angeles, CA, USA (8 Aug 1982).

This paper will identify the three basic parts of regulating disposal of high-level radioactive waste: (1) establishing a standard of acceptable risk; (2) developing a disposal capability in the form of a geologic repository; (3) licensing of a geologic repository. It will identify the principals at the Federal Level responsible for accomplishing each part; namely, the Environmental Protection Agency (EPA), the Department of Energy (DOE), and the Nuclear Regulatory Commission (NRC), respectively. It will discuss, under an assumption of the existence of a standard of acceptable risk, the roles of NRC and DOE in terms of licensing--arriving at a judgment concerning protection of the public health and safety if waste is disposed in a geologic repository--and of licensability--that quality of a repository developed by DOE which will contribute to NRC's ability to arrive at a regulatory decision. The necessity that the fact of licensing be fully integrated into the repository development process is stressed.

11634 **The management of commercially generated radioactive waste and spent fuel.** Coffman, F.E. (U.S. Department of Energy, Washington, DC). *Proceedings, Intersociety Energy Conversion Engineering Conference;* 3: 1317-1322(Aug 1982). (CONF-820814—).

From 17. Intersociety Energy Conversion Engineering conference; Los Angeles, CA, USA (8 Aug 1982).

The current overall Commercial Waste Management program strategy is to identify three candidate geologic repository sites at which construction of exploratory shafts to depth will begin in CY 1983, to be completed by CY 1985. The three locations will likely be: in basalt flows on the Hanford Site; in welded volcanic tuff on the Nevada Test Site (NTS); and in a salt formation site to be determined in CY 1983. The Nuclear Fuel Cycle Program includes technology for the safe and economic closing of the back end of the light water reactor (LWR) nuclear fuel cycle, R & D on the breeder fuel cycle, and the development of waste forms that would meet requirements for safe disposal in a geologic media. Under the Remedial Action Program which includes four subprograms, work is underway for the elimination of residual radioactivity resulting from past nuclear operations at certain government-owned sites or at designated non-government sites.

11635 **Nuclear waste isolation-an overview.** McDowell, J.R. (Battelle-Columbus, Columbus, OH). *Proceedings, Intersociety Energy Conversion Engineering Conference;* 3: 1328-1330(Aug 1982). (CONF-820814—).

From 17. Intersociety Energy Conversion Engineering conference; Los Angeles, CA, USA (8 Aug 1982).

The Department of Energy's National Waste Terminal Storage (NWTS) Program is being conducted to implement a focused, comprehensive and timely U.S. effort to develop the necessary technology and provide the facilities required for the safe, environmentally acceptable, permanent disposal of commercially generated high-level and transuranic radioactive waste. The NWTS Program strategy and major thrust are directed at providing isolation of the waste in mined geologic disposal repositories with the first repository available by the 1990's. Safe isolation of the waste from the biosphere is to be achieved through reliance on natural barriers and the provision of man-made barriers. Successful isolation appears feasible for periods of thousands of years. Long-term performance uncertainties can be bounded and are believed to be within limits of acceptable risk. Program implementation risks have been identified and are being addressed.

11636 **Radioactive waste treatment using zeolites.** Mikhail, K.Y. Salford, England; Salford University (1981). 231p. British Library, Boston Spa, Wetherby, West Yorks. No. D39649/82.

One of the more attractive methods for the removal of cesium and strontium radioisotopes from nuclear waste, particularly from considerations of efficiency and volume reduction, is ion-exchange. Radiochemical methods were employed to investigate the uptake of cesium-137 and strontium-90 by synthetic type A zeolite and two natural clinoptilolites. Their physical and chemical properties were determined and compared with the same zeolites treated by heat and alkaline solution. Thermal stability of type A zeolite containing various amounts of barium was studied using reversible cation exchange and thermal and x-ray measurements were made. Particle size was determined by electron microscopy and Si/Al ratio was measured using electron scanning micrographs. Leachability of Cs-137 and Sr-90 from zeolite and zeolite-cement composites in distilled water, sea water and pond water were studied. The diffusion coefficients were determined using Carman and Haul approach and the results were compared with the proposed IAEA method. Calcined NaBaCs A and NaBaSr A were found to show a lower leachability and this result offers a promising method for the management and disposal of radioactive waste. (author).

11637 **Modeling by GASP-IV simulation of high-level nuclear waste disposal.** Kurstedt, H.A. Jr. (Virginia Polytechnic Inst. and State Univ., Blacksburg); DePorter, E.L.; Turek, J.L.; Funk, S.K.; Rasbach, C.E. pp 86-89 of Proceedings of the IASTED energy symposia: modelling, policy and economics of energy and power systems; alternative energy sources and technology. Hamza, M.H. (ed.). Anaheim, CA; ACTA Press (1981). (CONF-810574—).

From International Association of Science and Technology for Development energy symposium; San Francisco, CA, USA (20 May 1981).

High-level nuclear waste generated by defense-oriented and commercial nuclear energy activities are to be stored ultimately in underground repositories. Research continues on the waste-form and waste-form processing. DOE managers must coordinate the results of this research, the capacities and availability times of the permanent geologic storage repositories, and the capacities and availability times of interim storage facilities (pending availability of permanent repositories). Comprehensive and active DOE program-management information systems contain predicted generation of nuclear wastes from defense and commercial activities; milestones on research on waste-forms; and milestones on research and development, design, acquisition, and construction of facilities and repositories. A GASP IV simulation model is presented which interfaces all of these data. The model accepts alternate management decisions; relates all critical milestones, all research and development data, and the generation of waste nuclear materials; simulates the passage of time; then, predicts the impact of those alternate decisions on the availability of storage capacity for waste nuclear materials. 3 references, 3 figures.

11638 **Process for the removal of radium from acidic solutions containing same.** Scheitlin, F.M. US Patent Application 6-461,301. [nd]. 13p. Contract W-7405-ENG-26.

The invention is a process for the removal of radium from acidic aqueous solutions. In one aspect, the invention is a process for removing radium from an inorganic-acid solution. The process comprises contacting the solution with coal fly ash to effect adsorp-

tion of the radium on the ash. The radium-containing ash then is separated from the solution. The process is simple, comparatively inexpensive, and efficient. High radium-distribution coefficients are obtained even at room temperature. Coal fly ash is an inexpensive, acid-resistant, high-surface-area material which is available in large quantities throughout the United States. The invention is applicable, for example, to the recovery of ^{226}Ra from nitric acid solutions which have been used to leach radium from uranium-mill tailings.

11639 **Self-closing shielded container for use with radioactive materials.** Smith, J.E. US Patent Application 6-438,127. [nd]. 9p. Contract AC11-76PN00014.

A container for storage of radioactive material comprises a container body and a closure member. The closure member is coupled to the container body to enable the closure body to move automatically from a first position (e.g., closed) to a second position (open).

11640 **Filter apparatus.** Kuban, D.P.; Singletary, B.H.; Evans, J.H. US Patent Application 6-440,206. [nd]. 13p. Contract W-7405-ENG-26.

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A plurality of holding tubes are respectively mounted in apertures in a partition plate fixed in a housing receiving gas contaminated with particulate material. A filter cartridge is removably held in each holding tube, and the cartridges and holding tubes are arranged so that gas passes through apertures therein and across the the partition plate while particulate material is collected in the cartridges. Replacement filter cartridges are respectively held in holding canisters mounted on a support plate which can be secured to the aforesaid housing, and screws mounted on said canisters are arranged to push replacement cartridges into the cartridge holding tubes and thereby eject used cartridges therefrom.

11641 **Method for removing trace pollutants from aqueous solutions.** Silver, G.L. US Patent Application 6-471,566. [nd]. 41p. Contract AC04-76DP00053.

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A method of substantially removing a trace metallic contaminant from a liquid containing the same comprises: adding an oxidizing agent to a liquid containing a trace amount of a metallic contaminant of a concentration of up to about 0.1 ppM, and separating the homogeneously precipitated product from the liquid.

0530 Environmental Aspects

REFER ALSO TO CITATION(S) 11603, 11617, 11619, 11620, 11625, 11626, 11627, 11630, 11653, 12430, 12715, 12718, 12735

11642 **(CONF-831217—9) Salt project environmental assessment issues and plans.** McIntosh, W.H. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). 1983. Contract AC02-83CH10140. 6p. NTIS, PC A02/MF A01. Order Number DE84005286.

From 5. civilian radioactive waste management information meeting; Washington, DC, USA (12 Dec 1983).

The provisions for public hearings provide for the public to raise the questions it believes need answered before that confidence is established. This paper describes (1) questions raised in the public hearings on potentially acceptable sites, (2) the long process of providing answers to the questions, and (3) some ways for the participants in the process to become confident that enough is known to proceed through each step of repository development. 14 references, 4 tables.

11643 **(PNL—4432-6) Chemical species of migrating radionuclides at commercial shallow land burial sites. Quarterly progress report, July-September 1983.** Kirby, L.J.; Rickard, W.H.; Toste, A.P. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1983. Contract AC06-76RL01830. 38p. NTIS, PC A03/MF A01. Order Number DE84005442.

The primary purpose of this project is to develop an understanding of chemical processes that significantly influence the migration of radionuclides at commercial low-level waste burial sites. Chemical measurements of waste trench leachate and identification of chemical changes in leachate during migration will provide a basis for geochemical waste transport models. This project will produce for the US Nuclear Regulatory Commission (NRC) information to support guidance for implementation of 10 CFR 61, particularly in the development of criteria for low level waste disposal site selection, management, permanent closure and monitoring. This project will also produce information needed by the Commonwealth of Kentucky as they finalize plans to stabilize, close and monitor the Maxey Flats site. Current research results are presented for the following tasks: (1) chemical forms inorganic and organic radionuclide species; (2) subsurface migration and infiltration studies; (3) specific radionuclide mapping at Maxey Flats and other commercial shallow land burial sites; (4) ecological monitoring at commercial shallow land burial sites; and (5) technical program coordination for low-level waste research. 17 references, 6 figures, 3 tables.

11644 **(PNL—4686) LWR spent fuel approved testing materials for radionuclide release studies.** Barner, J.O. (Pacific Northwest Lab., Richland, WA (USA)). Jan 1984. Contract AC06-76RL01830. 68p. NTIS, PC A04/MF A01. Order Number DE84005870.

Criteria are defined for the selection of light water reactor (LWR) spent fuels for use as MCC-Approved Testing Materials (ATMs) in radionuclide dissolution and interaction studies. Fuel-related characteristics affecting the release of radionuclides from spent fuel are reviewed and their pertinency evaluated. ATM spent fuel criteria are defined and classes of ATM spent fuels are determined. The available inventory of government-owned LWR spent fuel is identified and current plans for acquisition by the MCC are summarized. The characterization data to be supplied with the spent fuel ATMs are also described. 11 references, 3 figures, 7 tables.

11645 **(PNL—4747) Assessment of unsaturated zone transport for shallow land burial of radioactive waste: summary report of technology needs, model verification, and measurement efforts (FY 1978 to FY 1983).** Jones, T.L.; Gee, G.W. (Pacific Northwest Lab., Richland, WA (USA)). Jan 1984. Contract AC06-76RL01830. 130p. NTIS, PC A07/MF A01. Order Number DE84005588.

Two main topics are addressed in this report. The first topic relates to the assessment process for shallow land burial site design. This overview includes basic descriptions of water balance, transport processes and technology needs for waste management at an arid (dry) site. The second topic deals with specific results of research activities at PNL related to water and radionuclide transport under arid, shallow land burial conditions. Technology needs at arid-zone (dry) sites are summarized and unique features of radionuclide disposal at dry sites are explained. The report emphasizes the need to understand the interaction between climate, soil, plants, engineered barriers, and buried waste in order to evaluate performance of a waste disposal system at a dry site. Water balance data, collected since FY 1978 at the Buried Waste Test Facility (BWTF) at Hanford, are used to illustrate the influence of climate variables (rainfall distribution patterns and evaporative conditions) on soil water storage and drainage at an arid site. For dry site conditions, with no vegetation and coarse soil, significant deep drainage was measured. Deep drainage below the root zone was also measured at a grass-covered site on the Hanford site after early spring rains, which emphasizes the need to carefully monitor site water balances even at arid (dry) sites. The monitoring technology, water balance, and radionuclide transport at arid sites are discussed, and the use of neutron probes, electrical resistance units, tensiometers, and psychrometers are explained, and examples are given on their applications in arid-site monitoring. Measurements of water flow and radionuclide transport coefficients needed to describe movement in unsaturated soils are documented. 40 references, 21 figures, 5 tables.

11646 **(PNL-SA—11652) Effects of crystalline FE and MN oxides on contaminant migration through soil liners.** Dodson, M.E.; Serne, R.J.; Gee, G.W. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1983. Contract AC06-76RL01830. 11p. (CONF-840245—2). NTIS, PC A02/MF A01. Order Number DE84005890.

From 6. symposium on management of uranium mill tailings, low-level waste, and hazardous waste; Fort Collins, CO, USA (1 Feb 1984).

Tailings solution, produced from tailings excavated at the Canonsburg, Pennsylvania UMTRAP site, was used in liner material column flow studies to test the attenuation characteristics of local borrow pit soil found adjacent to the tailings area. The effluents from linear columns, under saturated conditions, were sampled at fractional pore volumes and analyzed for macro cation, anion, trace metal and radionuclide contents. Solution displacement was allowed to continue until three pore volumes of tailings solution had contacted the liner material. In addition, two amended liner mixtures were contacted with Canonsburg tailings solution to assess the effects of crystalline iron and manganese oxides in attenuating contaminants. The amended mixes represented Canonsburg soil plus either 2% (dry wt basis) reagent grade iron oxide of 2% manganese saturated green sand zeolite. Attenuation of most trace metals and readionuclides was high in all three column studies, while macro ions, zinc, and the anions Cl and SO_4 showed limited signs of attenuation regardless of whether the soil was amended or not. In addition, there were no signs of excess leaching to Fe or Mn from the columns enriched with their oxides. General results indicate that the addition of iron and manganese oxides in their crystalline form is of little additional value compared to the attenuation of contaminants achieved with native iron and manganese oxides found as partial coatings on the silicate minerals of the unamended Canonsburg soil. 8 references, 3 figures, 3 tables.

11647 **(SAND—83-0391) Interim report on the modeling of the regional hydraulics of the Rustler Formation.** Barr, G.E.; Miller, W.B.; Gonzalez, D.D. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1983. Contract AC04-76DP00789. 55p. NTIS, PC A04/MF A01. Order Number DE84005859.

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The finite-element code ISOQUAD was used to simulate the head distribution within the two major water-bearing units of the Rustler Formation at the Waste Isolation Pilot Plant (WIPP), the Magenta and Culebra dolomites. Calculated migration of a continuously injected contaminant from an assumed smeared point source at the center of the site was observed in terms of concentration relative to the initial input. Migration rates of specific concentration fronts decreased with increasing time. The average rate of movement of the 10^{-3} relative concentration contour was less than 10m/y for the first 800 y in the Culebra Dolomite. By 800 y, the migration of this concentration front has essentially ceased. In the case of the Magenta Dolomite, the average rate of movement of the 10^{-3} relative concentration contour was 0.44 m/y for the first 676 y of continuous contaminant injection; the contaminant plume in the Magenta shows little movement thereafter. For reasons of scale, the plume calculation overestimates the actual rate of movement of contaminants. Particle velocities for selected streamlines, more characteristic of contaminant movement, are calculated. These particle velocities indicate groundwater travel times of ~ 130,000 y from the center of the WIPP site to a distance of 12.9 km (8 mi). The validity of the porous-medium approximation of the Rustler aquifers was examined by the evaluation of the drawdown portion of aquifer pump tests. Drawdown curves were successfully duplicated as a function of hydraulic conductivity, storativity, and well radius. Estimation of the effective radius examined in each well test indicates that there are no significant fluid-bearing fractures or channels within 60 m of tested wells. Because of variable test duration and in situ hydraulic properties, effective radii tested range from 37 to 1500 m (see Appendix A). 23 references.

11648 **(SKBF-KBS-TR—82-03) Migration of radionuclides in fissured rock. Some calculated results obtained from a model based on the concept of stratified flow and matrix diffusion.** Neretnieks, I. (Svensk Kaernbraenslefoersoerjning AB, Stockholm). 1982. 52p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE83703869.

Some computed results of radionuclide migration in fissured rock are presented. The computations are based on a model which describes flow as occurring in a multitude of independent fissures (stratified flow). This gives rise to strong dispersion of channeling. The radionuclide migration in the individual fissures is modelled by the advection equation on a parallel walled channel with porous walls. The nuclides may diffuse into the pores and sorb reversibly on the pore surfaces. The effluent rates of 23 important nuclides are presented as functions of distance and time for various of important parameters such as rock permeability, diffusion coefficients, release rates, time of first release, fissure spacing and fissure width distribution.

11649 **(SKBF-KBS-TR—82-04) Radionuclide chain migration in fissured rock. The influence of matrix diffusion.** Rasmuson, A.; Neretnieks, I.; Bengtsson, A.; Grundfelt, B. (Svensk Kaernbraenslefoersoerjning AB, Stockholm). Apr 1982. 69p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE83703870.

Diffusion into the rock matrix has a large impact on the migration of radionuclides in the geosphere. The aim of the present study is to investigate the effect of this mechanism on radionuclide chain migration. For this purpose a previously used numerical code TRUMP is extended to incorporate chain decay. The algorithm is also changed to directly include the decay terms. The extended version was given the acronym TRUCHN. Numerical solutions from TRUCHN are compared with the analytical solutions developed by Lester et al. A good agreement is obtained. To illustrate the impact of matrix diffusion on the arrival times to the biosphere of the members of a radionuclide chain a number of numerical calculations were done for the two chains U-238 to Th-230 to Ra-226 and Pu-239 to U-235 to Pa-231. The resulting curves are compared with the results for surface sorption (penetration depth 10^{-4} m) and volume sorption (complete penetration) obtained with the computer program GETOUT. The difference in first arrival times are very large. The arrival times in the surface and volume sorption cases, differ with as much as four orders of magnitude. The corresponding times for instationary diffusion are located between these extreme values. A daughter nuclide which is strongly sorbed may be heavily retarded if it is produced far inside the rock matrix and has a long way to diffuse before it reaches the flowing water. This effect is investigated, by considering diffusion only of a radionuclide chain, with analytical and numerical (TRUCHN) methods. Finally, in connection with the reconcentration effect, some means of describing the outflow of a daughter nuclide in terms of the outflow of its parent nuclide are proposed.

11650 **(SKBF-KBS-TR—82-05) Migration of radionuclides in fissured rock. Results obtained from a model based on the concepts of hydrodynamic dispersion and matrix diffusion.** Rasmuson, A.; Neretnieks, I. (Svensk Kaernbraenslefoersoerjning AB, Stockholm). May 1982. 90p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE83703871.

The migration of individual radionuclides in a porous medium where hydrodynamic dispersion takes place and where the radionuclides in the matrix of solid medium by diffusion has been calculated for a variety of cases. The cases center around the main case in the second KBS study on spent fuel. The main differences from the KBS study is the inclusion of matrix diffusion and the use of large dispersivities. The effluent rates of 23 important nuclides are presented as functions of distance and time for various values of important parameters such as rock permeabilidiffusion coefficients, release rates, time of first release, fissure spacing and longitudinal dispersion coefficients.

0540 Health And Safety

REFER ALSO TO CITATION(S) 11567, 11572, 11575, 11587, 11607, 11617, 11623, 11633

11651 **(DOE/SR/11036—T18) Repository receiving facility design support.** Cottrell, J.E.; Dabolt, R.J.; Steneck, P.D. (Allied-General Nuclear Services, Barnwell, SC (USA)). Jul 1983. Contract AC09-83SR11036. 105p. NTIS, PC A06/MF A01. Order Number DE84005614.

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This report provides preliminary design criteria and proposed design features to reduce the occupational radiation exposure and the transportation turnaround time during receipt of waste

shipments at a Federal high-level nuclear waste repository. A cost/benefit analysis is provided. Much of the data presented in previous reports was revised and upgraded to reflect current estimates of waste generation/receipt volumes so as to provide a baseline comparison case for the cost/benefit analysis. The National Waste Repository in Basalt receiving facility operational manpower requirements, estimated occupational dose exposures and capital cost estimates were revised by scaling factors based on the volume receipts. All capital cost estimates were expressed in terms of 1983 dollars. The repository receiving facility was divided into two main areas. The cask handling facility for unloading shipments of spent fuel high-level vitrified wastes and spent fuel cladding hulls, and the TRU-waste handling facility for unloading 55-, 80-, and 600-drum shipments. In both areas, remote handling techniques were employed as much as practical. Occupational dose estimates were formulated based on an operational time and motion survey for truck and rail shipping packages and reference dose maps for each corresponding package. 9 references, 5 figures, 22 tables.

11652 **(DOE/SR/11036—T19) Personnel exposure estimates associated with nuclear fuel reprocessing waste.** Boone, F.W.; Rogers, B.W. (Allied-General Nuclear Services, Barnwell, SC (USA)). Aug 1983. Contract AC09-83SR11036. 66p. NTIS, PC A04/MF A01. Order Number DE84005616.

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The operation design of the Barnwell Nuclear Fuel Plant (BNFP) calls for shipment of its wastes to either a low-level waste disposal site or to a Federal repository. This study analyzes the probable radiation dose accrued to the personnel involved in handling waste packages from all identified waste streams of the BNFP from generation to reception at destination and including transportation. The shielding characteristics of the transport packages were derived by assuming packaging in existing or prototyped casks. Possible combinations of waste forms and packages for which the projected dose exceeded DOT or NRC regulations for transport of radioactive materials were rejected. Legal weight truck and legal weight rail transport modes were assumed. Potential ways for reducing overall personnel exposure are considered, concentrating on the particular streams with the largest dose contributions. The personnel exposure estimates were determined using a computer program specifically designed for this purpose. This program is described in Appendix A. 9 references, 3 figures, 19 tables.

11653 **(ONWI—163) Development of release scenarios for geologic nuclear waste repositories: Where have we been. Where should we be going.** Burkholder, H.C. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). Sep 1980. Contract AC06-76RL01830. 24p. NTIS, PC A02/MF A01. Order Number DE84005832.

Geologic nuclear waste repositories have been analyzed for almost a decade to determine the conditions or situations that could lead to the initiation of radionuclide release from the waste. This problem has been approached from both the generic and system-specific perspectives, and the assessments have applied expert opinion, fault/event tree, and simulation methods. The results from these studies suggest an emerging consensus that certain scenarios are potentially important and others are unimportant. Past approaches to scenario analysis may have been limited by lack of emphasis on the concept of scenario analysis itself. Future work in the scenario analysis area should focus on strengthening the scientific basis of the analysis and the quantitative evaluation of the uncertainties in the predictions. 25 references.

11654 **(PB—84-119338) Differing radiological impact of the recycling of plutonium in the fuel cycle of light water reactors: waste materials under normal operating conditions.** Bouville, A.; Guetat, P.; Jones, J.A.; Kelly, G.N.; LeGrand, J. (Commission of the European Communities, Luxembourg). [nd]. 173p. (EUR—8251-FR). NTIS, PC E08/MF E08.

The radiological impact of the fuel cycle of light water reactors using enriched uranium fuel can be modified by recycling plutonium. The resulting differences are likely to appear at different stages of the fuel cycle. Those which account for the wastes from the various installations under normal operating conditions are evaluated. The differing radiological impact on the population of the European Community is evaluated for 10 tons of recycled fissile plutonium metal. The evaluation is undertaken for each stage of the fuel cycle, i.e. for the fabrication of the fuel, the operation of the reactors, the treatment and conversion of the fuel. Gaseous and liquid wastes are treated separately. The majority of the environmental characteristics affected by the wastes and representative of conditions in the European Community are considered in the evaluation of the radiological impact. The recycling of plutonium results in a reduction of the radiological impact of the waste materials arising from normal operating conditions by approximately 30% compared with a fuel cycle using enriched uranium. (Copyright (c) CECA-CEE-CEEA, Bruxelles-Luxembourg 1982.)

0550 Regulations

REFER ALSO TO CITATION(S) 11596, 11607

11655 **(DOE/RW—0001) Record of responses to public comments on proposed general guidelines for recommendation of sites for nuclear waste repositories.** (USDOE Assistant Secretary for Management and Administration, Washington, DC. Office of Civilian Radioactive Waste Management). 18 Nov 1983. 266p. NTIS, PC A12/MF A01. Order Number DE84005460.

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The Nuclear Waste Policy Act of 1982 (Public Law 97-425, referred to in this document as the Act) assigned to the US Department of Energy (DOE) the authority for the disposal of high-level radioactive waste and spent nuclear fuel. Among other provisions, the Act specifies a process and schedule for the siting of two geologic repositories for this purpose. The Act requires that the DOE issue general guidelines for the recommendation of sites for repositories. The guidelines are to be developed in consultation with three Federal agencies (the Council on Environmental Quality, the US Environmental Protection Agency, and the US Geological Survey) and with interested Governors and issued with the concurrence of the US Nuclear Regulatory Commission. To meet this directive, the DOE convened a task force of program experts to develop proposed guidelines, issued the proposed guidelines on February 7, 1983, and invited comments from the specified Federal agencies, interested Governors, and the general public. Public hearings on the proposed guidelines were held in March at the following locations: Chicago, New Orleans, Washington, DC, Salt Lake City, and Seattle. After considering the resulting comments and preparing responses to them, the task force prepared a draft of this comment-response document and a set of alternative guidelines; these documents were issued on May 27, 1983. This document summarizes the record of comments that directly led to the alternative guidelines of May 27, 1983. It contains synopses of comments, presents the responses of the task force to the comments, and briefly describes how the proposed guidelines of February 7, 1983, were revised to produce the alternative guidelines of May 27, 1983. 13 references.

11656 **(GAO/RCED—83-128) Usefulness of federally funded activities at the Barnwell Nuclear Fuel Plant.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 9 May 1983. 12p. US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760.

Objectives, scope and methodology are detailed for this study. Historical aspects of Barnwell's project and its federal funding are reviewed. GAO found that the government officials and industry representatives were familiar with the R and D work at Barnwell and were knowledgeable about reprocessing generally believe that the R and D activities have been useful. Specifically, they believe that the R and D activities have been useful in advancing the technology to safeguard special nuclear material, furthering the understanding of various reprocessing concepts, and developing meaningful data on spent fuel handling techniques. Auditors also found that Barnwell's facilities have been adequately maintained and a majority of its key personnel have been retained.

11657 (ORNL—5985) Certification document for newly generated contact-handled transuranic waste. Box, W.D.; Setaro, J. (Oak Ridge National Lab., TN (USA)). Jan 1984. Contract W-7405-ENG-26. 69p. NTIS, PC A04/MF A01. Order Number DE84005626.

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The US Department of Energy has requested that all national laboratories handling defense waste develop and augment a program whereby all newly generated contact-handled transuranic (TRU) waste be contained, stored, and then shipped to the Waste Isolation Pilot Plant (WIPP) in accordance with the requirements set forth in WIPP-DOE-114. The program described in this report delineates how Oak Ridge National Laboratory intends to comply with these requirements and lists the procedures used by each generator to ensure that their TRU wastes are certifiable for shipment to WIPP.

11658 (SAAS—307) Accounting for and control of nuclear material at the Central Institute of Nuclear Research, Rossendorf. Heidel, S.; Rossbander, W.; Helming, M. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). 1983. 17p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704367.

A survey is given of the system of accounting for and control of nuclear material at the Central Institute for Nuclear Research, Rossendorf. It includes 3 material balance areas. Control is implemented at both the institute and the MBA levels on the basis of concepts which are coordinated with the national control authority of the IAEA. The system applied enables national and international nuclear material control to be carried out effectively and economically at a minimum of interference with operational procedures.

11659 Applications of safeguards instruments at fuel cycle facilities. Higinbotham, W.A. (Brookhaven National Lab., Upton, NY (USA)); Waddoups, I.G. (Sandia National Labs., Albuquerque, NM (USA)). pp 429-441 of Nuclear power experience. Proceedings of an international conference held by the IAEA in Vienna, 13-17 September 1982. Vol. 5 is entitled "Advanced systems and international co-operation". Vienna, Austria; International Atomic Energy Agency (1983). (CONF-820914—Vol.5; IAEA-CN—42/415).

From International conference on nuclear power experience; Vienna, Austria (13 Sep 1982).

The IAEA employs the complementary measures of material accountancy, containment and surveillance to provide timely detection of the possible diversion of nuclear materials. Instrumentation is becoming increasingly important for the independent measurement of nuclear materials and to maintain continuity of knowledge of their status. This paper presents a summary of the types of instruments at present in use and of instruments under development, with reference to how the instruments may be used by inspectors at specific types of nuclear fuel cycle facilities.

11660 Present status of near-real-time materials accounting. Shipley, J.P.; Hakkila, E.A. (Los Alamos National Lab., NM (USA)). pp 443-452 of Nuclear power experience. Proceedings of an international conference held by the IAEA in Vienna, 13-17 September 1982. Vol. 5 is entitled "Advanced systems and international co-operation". Vienna, Austria; International Atomic Energy Agency (1983). (CONF-820914—Vol.5; IAEA-CN—42/282).

From International conference on nuclear power experience; Vienna, Austria (13 Sep 1982).

An essential step in the development of international safeguards technologies is the demonstration that safeguards elements are cost effective and operationally acceptable in actual nuclear facilities, and that safeguards data can be verified independently by the International Atomic Energy Agency. Near-real-time accounting is being pursued as a method for improving the timeliness and diversion detection sensitivity of conventional accounting procedures. Acceptability of near-real-time accounting for international safeguards depends on: (i) Development of measurement techniques (process control, NDA, laboratory) that provide the required sensitivity and timeliness. The measurements must address transfers through the material balance area (MBA) and material in process. The latter often can limit detection sensitivity for short-term diversion. (ii) Proper consideration of measurement control programmes. The calibration procedures and frequencies are important in controlling correlated measurement errors, and significant improvements in detection sensitivity can be realized through changes in the measurement control programme. (iii) Development of statistical techniques to evaluate measurement data. The statistical evaluation procedures should test a spectrum of diversion scenarios (abrupt or protracted) and should be adapted to the specific process and understood by safeguards personnel. (iv) Demonstration that the materials accounting results can be verified independently by the Agency. Independent verification should deal with possible diversion through data falsification, and diversion hidden in measurement uncertainties. (v) Demonstration of the safeguards system under operational plant conditions. Each of these areas is considered in the Los Alamos development programme for near-real-time accounting and is discussed in the paper.

11661 Experience in SSAC training and technology transfer. Hatcher, C.R. (Los Alamos National Lab., NM (USA)); Keepin, G.R.; Pontes, B. (International Atomic Energy Agency, Vienna (Austria)). pp 207-217 of Nuclear safeguards technology 1982. Proceedings of an international symposium on recent advances in nuclear material safeguards organized by the IAEA and held in Vienna, 8-12 November 1982. Vienna, Austria; IAEA (1983). (IAEA-SM—260/80; CONF-821119—).

From International symposium on recent advances in nuclear materials safeguards; Vienna, Austria (8 Nov 1982).

Each year since 1980 an international training course on the implementation of States' Systems of Accounting for and Control of Nuclear Materials (SSACs) has been offered in the USA under the auspices of the Nuclear Non-Proliferation Act of 1978. The courses are sponsored by the US Department of Energy in cooperation with the International Atomic Energy Agency (IAEA) and conducted by the Los Alamos National Laboratory, with the assistance of other organizations. The purpose of the courses, which are described in detail in the paper, is "to provide practical training in the design, implementation and operation of a national system of accounting for and control of nuclear materials that satisfies both national and IAEA international safeguards objectives." On odd numbered years, the course emphasis is on bulk-processing facilities; on even years the emphasis is on item-dominant facilities. Internationally known authorities are selected as course lecturers from the IAEA and Los Alamos, as well as government, industry, and national laboratories in both the USA and abroad. Lectures are supplemented with workshops, panel discussions, tours of Los Alamos safeguards laboratories, and visits to operating nuclear fuel-cycle facilities. Attendance at the 1981, 1982 and 1983 SSAC courses has averaged 26 student participants, with almost as many nations represented. The overall response to the courses has been highly favorable, indicating that they are fulfilling a timely and important need. Key to the success has been a course format that encourages maximum exchange of safeguards technology and experience among all participants, both students and lecturers.

11662 Accuracy of neutron coincidence counting on plutonium by using a coincidence counter (shift register). Neuilly, M.; Thaurel, B.; Monnier, J. Saint-Paul-les-Durance, France; CEA Centre d'Etudes Nucleaires de Cadarache (1983). 7p. (In French). (CONF-830423—16; CEA-CONF—6718). CEN Saclay, Service de Documentation, 91191 - Gif-sur-Yvette Cedex (France).

From 5. symposium on safeguards and nuclear material management; Versailles, France (19 Apr 1983).

Calculations of quantity of PuO_2 is done by using two analytical factors: on the one hand the real coincidences R, on the other hand the ratio X=A/R which is independent of efficiency of detection. By using Ensslin method, we correct the effect of induced fissions. Results show that adjustements of induced fissions reduce errors born of multiplicative effects. This error is smaller than 10% and even better when determining the ratio X instead of

the difference R. Results of measurements are also in agreement with reproducibility calculation.

06 FUSION FUELS

0601 Sources

11663 **Lithium aluminate/zirconium material useful in the production of tritium.** Cawley, W.E.; Trapp, T.J. US Patent Application 6-488,825. [nd]. 6p. Contract AC06-76RL01857.

A composition is described useful in the production of tritium in a nuclear reactor. Lithium aluminate particles are dispersed in a matrix of zirconium. Tritium produced by the reactor of neutrons with the lithium are absorbed by the zirconium, thereby decreasing gas pressure within capsules carrying the material.

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

REFER ALSO TO CITATION(S) 11868

0701 Physical Isotope Separation

11664 **(PB—84-115039) Discovery of heavy hydrogen and heavy water. Internal report.** Saylor, C.P. (National Bureau of Standards, Washington, DC (USA). Library Div.). Oct 1983. 11p. (NBSIR—83-2778). NTIS, PC A02/MF A01.

This report is a brief account prepared by request of Walter Weinstein for Dr. C. P. Saylor some years prior to his death in April 1982. It has been carefully reviewed by several present and former staff members, including former NBS scientis, Dr. F. G. Brickwedde, who participated with Dr. Harold C. Urey and others in the experiments and events described by Saylor. In his review Dr. Brickwedde, now Evans Pugh Research Professor of Physics emeritus at Pennsylvania State University, stated that 'Dr. Saylor's paper covers an important part of the history of the discovery of deuterium that is not so well known ... and contains information important for the chemical historian.

11665 **(UVVVR—8) Impurities in radionuclide materials.** Dryak, P.; Novotna, P.; Kokta, L.; Kovar, P. (Ustav pro Vyzkum, Vyrobu a Vyuziti Radioisotopu, Prague (Czechoslovakia)). 1981. 105p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE83703879.

The manual sums up the experiences of the spectroscopy laboratory of the UVVVR, gained with the determination of impurities in materials used for the preparation of standards. The main equipment for the determination of impurities was a spectrometer with a Ge(Li) semiconductor detector of 80 cm^3 in sensitive volume. Data were obtained either by own compilation of data published in the literature or from Tables of radionuclides. Great attention was focused on the determination of half-life values and the yields of photons of those nuclides which are usually used as spectrometric standards. The tables contain: 1) half-life, 2) method of radionuclide production, 3) usually the main components of alpha or beta radiation or the electron capture intensity, depending on the decay type, 4) emitted photons, their energies and intensities; for transitions used as standards the intensities were determined as the average value of published data, 5) impurities found; impurities detected by UVVVR spectroscopic laboratory; in case of the regular occurrence of impurities; their typical or average amounts are stated; the detection limit is given for each radionuclide, 5a) possible impurities; found in other laboratories or are believed logical, 6) conditions and methods of measurements; suitable detector type, interesting energy region and other details applicable to a specific radionuclide.

11666 **On-line production of ^{13}N-nitrogen gas from a solid enriched ^{13}C-target and its application to ^{13}N-ammonia synthesis using microwave radiation.** Ferrieri, R.A.; Wieland, B.W.; Wolf, A.P. (Brookhaven National Lab., Upton, NY (USA)); Schlyer, D.J. (Cyclotron Corp., Berkeley, CA (USA)). *International Journal of Applied Radiation and Isotopes;* 34: No. 6, 897-900(Jun 1983).

A novel solid ^{13}C-enriched target has been developed for the production of ^{13}N as nitrogen gas using the ^{13}C(p,n) ^{13}N nuclear reaction. The target is of the flow-through type which allows for on-line recovery and separation of the radionuclide from the enriched target matrix and permits reuse of the target without detriment to its production capability. A direct application of this target was found in the development of a technique where ^{13}N-ammonia could be synthesized by exposing ^{13}N-labeled nitrogen gas plus hydrogen to a microwave discharge.

0702 Radiation Sources

11667 **(PB—84-921000) FDA (food and drug administration) compliance program guidance manual (fy 84). Section 6. Radiological health. Updates. Irregular repts.** (Food and Drug Administration, Rockville, MD (USA)). 1984. 1p. Paper copy available on Standing Order, Deposit Account required. North American Continent price $50.00/year; all others write for quote. Single copies also available in paper copy only. Basic report available as PB84-921099.

The standing order allows one to obtain updates to Section VI of the Compliance Program Guidance Manual which provides plans and instructions to Field operatons which are surveillance and/or compliance oriented and provide needed direction from Headquarters Offices and Bureaus in accomplishing FDA's regulatory obligations for those products monitored for radiation. This section also includes the concept to the Manual and miscellaneous material relating to compliance functions.

11668 **(PB—84-921099) FDA (food and drug administration) compliance program guidance manual (fy 84). Section 6. Radiological health.** (Food and Drug Administration, Rockville, MD (USA)). Oct 1983. 585p. NTIS, PC A^{4}20.00.

The FDA Compliance Program Guidance Manual provides a system for issuing and filing written program plans and instructions directed to Food and Drug Administration Field operations for project implementation. Section VI provides those chapters of the Compliance Program Guidance Manual which pertain to the area of radiological health. Some of the areas of coverage include laser standards; compliance testing of x-ray equipment, ultrasonic therapy devices, mercury vapor lamps, television receivers, and microwave ovens; radiation policy; and imported electronic products.

0703 Isotopic Power Supplies

11669 **(GA-A—16233) Radioisotope space power generator. Annual report, October 1978-September 1979.** Elsner, N.B.; Chin, J.; Staley, H.G.; Bass, J.C.; Morris, C.C.; Shearer, C.H.; Steeger, E.J. (GA Technologies, Inc., San Diego, CA (USA)). Mar 1982. Contract AT03-76SF70060. 96p. NTIS, PC A05/MF A01. Order Number DE84005675.

The emphasis of the Isotec Technology Program shifted from development of a Galileo generator to study of a segmented selenide element and couple technology. The goal of the FY 79 program was to determine the feasibility of fabricating segmented selenide P and N elements which exploit the high thermoelectric efficiency of $(Cu,Ag)_2Se$ and Gd_2Se_3 materials. A preliminary evaluation of segmented element efficiencies, material compatibilities, and fabrication abilities was used to select $(Cu,Ag)_2Se$/$Fe(Bi,Sb)_2Te_3$ for the P element and Gd_2Se_3/PbTe for the N element. The iron barrier between the $(Cu,Ag)_2Se$ and $(Bi,Sb)_2Te_3$ prevented degradation of thermoelectric properties from copper contamination of the $(Bi,Sb)_2Te_3$. Fabrication processes for both elements were developed. Gd_2Se_3 was friable and difficult to fabricate crack-free. It also exhibited a phase transition from cubic to orthorhombic, which increased its susceptibility to microcracking and reduced its thermoelectric efficiency. Life testing of an all-

bonded couple with unsegmented $(Cu,Ag)_2Se$ P-type and Gd_2Se_3 N-type elements was stopped after 3300 h in a nominal 830°C/390°C thermal gradient. The Gd_2Se_3 leg did not show any significant degradation during the test. Examination of the hot end of the P element showed the need for a less reactive hot cap material and an improved vapor supression system. Module testing of a 1-W $(Bi,Sb)_2(Se,Te)_3$ generator was performed for 5000 h with no degradation in power. High-temperature Thermid 600 adhesive curing cycles were examined, 75-mW module loading tests were performed, and diagnostic examination of RTG-2A and RTG-201 was completed.

11670 **(LA—9939-PR) Space nuclear safety program. Progress report, July 1983.** Bronisz, S.E. (comp.). (Los Alamos National Lab., NM (USA)). Nov 1983. Contract W-7405-ENG-36. 7p. NTIS, PC A02/MF A01. Order Number DE84003558.

This technical monthly report covers studies related to the use of $^{238}PuO_2$ in radioisotope power systems carried out for the Office of Special Nuclear Projects of the US Department of Energy by Los Alamos National Laboratory. Most of the studies discussed here are ongoing. Results and conclusions described may change as the work continues.

08 HYDROGEN

0801 Production

11671 **(NP—4770072) Experimental studies with metal-hydrogen-systems for the development of the Li/LiH-process.** Weirich, W. (Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Maschinenwesen). 25 Jan 1982. 129p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84770072.

In this work an attempt is made to further develop the Li/LiH-process, which is a hybrid cyclic process, for the thermochemical splitting of water. The studies presented are related with the more critical aspects of the method, such as the development of the membrane on the basis of homogeneous alloys, and the segregation of hydrogen from Li/LiH-melts.

11672 **(NP—4770077) Thermodynamic and engineering assessment of hybrid processes for the production of hydrogen with specific application to the MARK 13 process.** Joels, R.K. (Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Maschinenwesen; Commission of the European Communities, Ispra (Italy). Joint Research Centre). 19 Oct 1981. 111p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE84770077.

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The thermodynamic theory of thermo-chemical and hybrid cycles is developed and subsequently applied to the Mark 13 cycle. A review of the experimental work then follows, the results of which are used partly as the basis of an engineering evaluation.

11673 **(PB—84-121235) Study of failures of a 2.4 MW electrolyser prototype. Final report, 1 November 1980-31 December 1981.** (Commission of the European Communities, Luxembourg). [nd]. 293p. (EUR—8192-FR). NTIS, PC E12/MF E12.

Because of the importance of reliability and safety in large-scale electrolysers for the mass production of hydrogen, a study has been undertaken with the aim of classifying and analysing causes of failures and providing solutions. The analyses have been applied to a prototype 2.4-MW electrolyser. The study concerning the causes and consequences of failures involves two parts: (a) a general reliability study at complete system level, and (b) a detailed study of each of the foreseeable failures, based either on experiment or on calculation.

11674 **Photogeneration of hydrogen from polymeric viologen systems.** Lee, P.C.; Matheson, M.S.; Meisel, D. (Argonne National Lab., IL). *Israel Journal of Chemistry;* **22**: 133-137(1982). Contract W-31-109-ENG-38.

Polymers containing pendant viologen groups were prepared and studied for their quenching efficiencies of the $Ru(bpy)_3^{2+}$ excited state, their back reactions following the quenching, their viologen radical yields, and finally for their effectiveness in hydrogen production in the presence of colloidal platinum. Results are compared with those from methyl viologen containing systems to evaluate the performance of the polymeric viologen systems.

0802 Storage

11675 **Metal hydride slurries.** Reilly, J.J.; Grohse, E.H.; Jognson, J.R. (Brookhaven National Lab., Upton, NY). pp 537-539 of 5th Miami international conference on alternative energy sources. Vezirogla, T.N. (ed.). Coral Gables, FL; Univ. of Miami (1983). (CONF-821213—). Contract AC02-76CH00016.

From 5. international conference on alternative energy source; Miami Beach, FL, USA (13 Dec 1982).

09 OTHER SYNTHETIC AND NATURAL FUELS

11676 **(AD-A—952030/5) Charcoal: production, marketing, and use.** Toole, A.W.; Lane, P.H.; Arbogast, C. Jr; Smith, W.R.; Peter, R. (Forest Products Lab., Madison, WI (USA)). Jul 1961. 141p. NTIS, PC A07/MF A01.

Charcoal will undoubtedly continue to be made for the most part from wood. This report provides information for the manufacture of charcoal in various kinds of equipment, from rather simple, inexpensive kilns to elaborate, costly byproduct-recovery plants. This information is based on Forest Service research conducted on a broad scale to stimulate conversion of low-quality wood to this widely marketable product. It is emphasized, however, that only when certain controlling factors, such as initial investment, labor and raw material costs, production efficiency, and markets, are fully considered can there be reasonable assurance of success. The important role these factors play in charcoal production is clearly shown in experience gained from experimental kiln production. Charcoal is produced by heating wood under conditions that permit the use of little or no oxygen or in limited, regulated amounts available for retarded combustion. That this point has particular significance is emphasized in much of this report.

11677 **(CONF-830567—6) Biothermal conversion of biomass and wastes to methane.** Chynoweth, D.P.; Srivastava, V.J. (Institute of Gas Technology, Chicago, IL (USA)). 1983. Contract W-7405-ENG-26. 39p. NTIS, PC A03/MF A01. Order Number DE84006052.

From 5. symposium on biotechnology for fuels and chemicals; Gatlinburg, TN, USA (10 May 1983).

This paper describes the BIOTHERMGAS process for conversion of biomass and wastes to substitute natural gas (SNG) and/or medium-Btu gas. This process combines biological and thermochemical unit operations into a scheme that can efficiently convert the full spectrum of biomass or waste feedstocks (regardless of moisture and nutrient contents) to methane or other fuel products with minimum process residues. The BIOTHERMGAS process employs biogasification followed by thermochemical gasification of dewatered refractory digester residues. Nitrogen and other inorganic nutrients are recycled from the thermal process effluent to the biogasification unit. The product gas from the thermochemical gasifier can be converted to methane either by catalytic methanation or by biomethanation. The waste heat from thermal product gases is used to supply the heat requirement of the bioconversion component. The preliminary systems analyses were conducted on five applications of the BIOTHERMGAS process: three using biomass (Bermuda grass) and two using municipal wastes as feedstocks. Results indicate that this process is technically superior to either biological or thermochemical processes. The results of preliminary economic analyses and laboratory studies also show this process to be economically and technically feasible.

11678 (CONF-8011203—, pp 31-47) **State of biogas process development: Systems, construction modes, construction materials and problems.** Schulz, H. 1981. (In German). NTIS (US Sales Only), PC A05/MF A01.

From Meeting on manure treatment and biogas; Kitzingen, F.R. Germany (13 Nov 1980).

For the construction of biogas plants, construction materials like reinforced concrete, moulded concrete bricks, sheet steel, wood and plastics are suited. Next to concrete, sheet steel in corrosion-proof configuration is used most frequently with biogas plants. The fermentors may be lined with various plastic materials. Different methods of gas storage are presented.

11679 (CONF-8011203—, pp 48-76) **First experience gained with new biogas plants and their profitability.** Perwanger, A. 1981. (In German). NTIS (US Sales Only), PC A05/MF A01.

From Meeting on manure treatment and biogas; Kitzingen, F.R. Germany (13 Nov 1980).

A brief survey on more recent biogas plants in Bavaria is given which are serviced by the Landtechnik Weihenstephan. Investment cost, profitability, modes of construction and function as well as possible means and methods of heat recovery and gas storage are demonstrated with the individual plants located at different farms.

11680 (CONF-8011203—) **Manure handling and processing. Biogas.** (Bayerische Landesanstalt fuer Landtechnik, Freising (Germany, F.R.)). 1981. 79p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84770151.

From Meeting on manure treatment and biogas; Kitzingen, F.R. Germany (13 Nov 1980).

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The meeting informed on disposal and handling of nutreated and aerated manure, as well as about constructional design and economics of the new biogas process and equipment.

11681 (DOE/ER/10399—T1) **Development of catalysts for the utilization of carbon monoxide. Final report, May 1, 1981-December 31, 1982.** Kyba, E.P.; Pettit, R. (Texas Univ., Austin (USA)). 1983. Contract AS05-79ER10399. 6p. NTIS, PC A02/MF A01. Order Number DE84005475.

Research was conducted μ-methylene-dimella species and on heterogeneously catalyzed reactions. $Fe(CO)_8^{2-}$ reacts with methylene iodide to give the parent bridging methylene complex which reacts with olefins and acetylenes in heterogeneous Fischer-Tropsch reactions. The formation of hydrocarbons was studied. Alcohols were studied as substrates for Fischer-Tropsch reactions. (DLC)

11682 (ENEA-RT/FARE-SIN—83-2) **Complete census of biogas plants using animal wastes operating in Italy.** Bozza, E.; Calzolari, C.; De Poli, F.; Ercoli, L.; Ferrante, E.; Tilche, A. (Comitato Nazionale per l'Energia Nucleare, Casaccia (Italy). Dipartimento Fonti Alternative Rinnovabili e Risparmio Energetico). 1983. 27p. (In Italian). (CONF-8304145—1). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84900246.

From 1. international congress on energy and agriculture; Milano, Italy (27 Apr 1983).

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A complete census of all the biogas plants operating or under construction today in Italy has been carried out. This shows that more than 70 full-scale plants treating animal wastes are in operation. There are several pilot and experimental plants built by many Italian firms that design and sell anaerobic digesters and by various research groups of Universities and Governmental Agencies. Some plants, among which large-size ones, have been self-built by farmers. Then the analysis of daily biogas production allowed to determine real parameters of specific production for various kinds of animal wastes and animal farms.

11683 (PB—84-100460) **Economic and systems assessment of the concept of a water hyacinth wastewater treatment/methane production system. Final report May 82-May 83.** (Black and Veatch Consulting Engineers, Kansas City, MO (USA)). May 1983. 207p. NTIS, PC A10/MF A01.

Production of pipeline-quality gas from anaerobic digestion of hyacinth-sludge blends is possible with current technology. The cost varies from $2.54 per thousand cubic feet, associated with primary and hyacinth treatment of 50 million gallons per day of raw waste, to $75.30 per thousand cubic feet associated with hyacinth polishing of one million gallons per day of secondary effluent. The $2.54 cost includes a large credit for wastewater treatment of $28.20. These costs correspond to a municipal system with U.S. Environmental Protection Agency participation in treatment works' capital cost. If the ownership shifts to industrial financing, the cost increases to $6.74 for the 50 million gallon per day system. The major cost element common to all systems evaluated is harvesting of hyacinths. Maximum energy production potential is less than 0.002 quads for an area which includes all wastewater treatment plants (projected to the year 2000) for the nation's southern tier states with a flow of more than five million gallons per day. Addition of other material to the anaerobic digestion feedstock could increase the quad impact.

0901 Properties

11684 (PB—84-104538) **Characterization of exhaust emissions from operation of a light-duty gasoline vehicle on alternate source gasoline fuels. Final report.** Smith, L.R. (Southwest Research Inst., San Antonio, TX (USA)). Aug 1983. 114p. NTIS, PC A06/MF A01.

This report describes the laboratory effort to characterize regulated and unregulated exhaust emissions from a 1981 Volkswagen Rabbit operating on Amoco Indolene gasoline and five alternate-source fuels or fuel blends. These five alternate-source fuels included Mobil MTG gasoline, Simulated Coal gasoline, EDS Naphtha blend, Sasol blend (lead chemically removed), and H-Coal Naphtha blend. The test vehicle was operated over the Light-Duty Federal Test Procedure (FTP) and the Highway Fuel Economy Driving Schedule (HFET). Exhaust constituents measured, in addition to the regulated emissions, included aldehydes and ketones, particulate, individual hydrocarbons, sulfate ammonia, cyanide, organic amines, organic sulfides, phenols, nitrosamines, benzo(a)-pyrene and major elements in particulate.

11685 (PB—84-104702) **Calculation of emissions and fuel economy when using alternate fuels. Final report May 82-Sep 82.** Urban, C.M. (Southwest Research Inst., San Antonio, TX (USA)). Mar 1983. 100p. (EPA—460/3-83-009). NTIS, PC A05/MF A01.

This report provides methods for the calculation of vehicle emissions and fuel consumption when nonstandard fuels are used. Methods of analyses, required for evaluation of alternate fuels, are included by reference or as Appendices to this report.

11686 (PB—84-104959) **Gasification kinetics for biomass decomposition. Final report Jul 80-Jun 82.** Simmons, G.M.; Lee, W.H. (Idaho Univ., Moscow (USA)). Jul 1982. 29p. NTIS, PC A03/MF A01.

By measuring the rate of gas evolution from both thermally decomposing cellulose and wood, pyrolysis kinetic rate constants have been determined. For cellulose, the results indicate that gaseous formation occurs via two or more parallel pathways. For wood pyrolysis, two separate decomposition regions have been identified, with the second region (in time) corresponding to the decomposition of the cellulose constituent in wood, and the first region corresponding to hemicellulose decomposition. Experimentally, a small sample (20 mg) of cellulose is charged to a heated reactor and held on a fine wire mesh screen (425 mesh). A preheated helium sweep gas removes the volatile products from the reaction zone. A continuous IR-detector is used to monitor the carbon monoxide concentration and periodic samples are analyzed by gas chromatography. This technique is therefore a direct measurement of the rate of gas evolution as opposed to weight loss measurements using thermogravimetric analyses.

11687 **(PB—84-123678) Chemistry of biomass gasification. Annual report, July 1982-June 1983.** Shafizadeh, F.; DeGroot, W.F. (Montana Univ., Missoula (USA). Wood Chemistry Lab.). Jul 1983. 46p. NTIS, PC A03/MF A01.

Gasification of carbon in any form involves a complex interaction of the solid and gaseous phases, the details of which are poorly understood at present. The primary objective of this research program is to determine the composition and reactivity of chars prepared from wood and treated wood under a variety of conditions. The combined knowledge of chemical functionality and reactivity will provide better understanding of the role of chemical functional groups in the gasification of biomass chars in particular, and will apply in general to any chars having similar chemical composition. The results of this research will also indicate the roles of natural mineral components (ash) and added inorganic catalysts during char formation and gasification. This additional insight into the relationship between structure and reactivity will allow better selection of process variables to produce highly reactive chars and to direct the gasification process toward the production of desired products.

11688 **(PB—84-123686) Fischer-Tropsch catalysis. Final report, 1 June 1982-31 May 1983.** Andersen, R.A. (California Univ., Berkeley (USA). Dept. of Chemistry). 1 Jun 1983. 13p. NTIS, PC A02/MF A01.

Fischer-Tropsch catalysis, a heterogeneous catalytic reaction that converts carbon monoxide and hydrogen to organic alcohols and hydrocarbons, is an old though not well understood reaction. This lack of mechanistic understanding prevents the design of new and better catalytic systems. Our approach is to use homogeneous systems to model two fundamental reactions important in Fischer-Tropsch chemistry: insertion of carbon monoxide into a metal-carbon bond and carbon-carbon bond formation.

11689 **Use of pyrolysis-derived fuel in a gas turbine engine.** Kasper, J.M.; Jasas, G.B.; Trauth, R.L. (Combustion Teledyne CAE, Toledo, OH). *American Society of Mechanical Engineers, [Paper]*: 83-GT-96: 8(1983). (CONF-830309—). Contract AC03-78ET13333.

From 28. ASME international gas turbine conference; Phoenix, AZ, USA (27 Mar 1983).

Combustion of a pyrolytically derived oil has been demonstrated in a J69-T-29 gas turbine combustor rig. The fuel was derived from agricultural and forest products/wastes through a pyrolysis conversion process which yields the oil and a residual char. The char was ground to a mean size of 25 microns and mixed with the oil and JP-4 in additional combustor rig tests. Analysis of the oil and char showed that both have hydrogen/carbon ratios less than 1.0 for the combustible components. The oil has a water content of 29%, a room temperature viscosity of 250 cS, and a pH of 2.9. The combustion system of the J69 consists of an annular combustor and a centrifugal fuel injector rotating as shaft speed. The centrifugal fuel injector can use slurry fuels without clogging and provides good atomization with viscous fuels. The combustor rig was operated at pressures and temperatures lower than those of the engine, and JP-4 was used as a baseline fuel. Test results indicate that use of pyrolytic oil will result in engine combustion efficiencies of over 99%. The pyrolytic oil may also be used as a supplement to JP-4. Additional development will be necessary to use the pyrolytic char as a gas turbine fuel.

11690 **(DOE/ET/00087—T1) Novel reactor schemes for pentosan and hexosan hydrolysis. Final report.** Mutharasan, R.; Grossmann, E.D. (Drexel Univ., Philadelphia, PA (USA). Dept. of Chemical Engineering). Sep 1981. Contract FG02-79ET00087. 82p. NTIS, PC A05/MF A01. Order Number DE84005238.

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This report covers the progress made during the two years of support period, September 1979 to September 1981. The overall objective of the research program at Drexel is to obtain concentrated sugar solutions by acid hydrolysis of biomass in concentrated slurry systems. The sub-objectives are: study of hydrolysis kinetics in low liquid/solids slurries - of pentosans and hexosans; development of a microwave heated cavity for rapid heating of biomass slurries so that high temperature, short reaction time hydrolysis can be carried out. The key contributions of this study are: in concentrated slurry systems, the rate of hydrolysis is better described by acid loading (gms of acid/gm of biomass) rather than the traditional parameter of acid concentration; yield of sugars is improved by carrying out the hydrolysis reaction in an inert liquid medium; and there appears to be a critical acid loading necessary to initiate hydrolysis of pentosans. 20 figures, 2 tables.

11691 **(DOE/R4/10311—T1) Small-scale alcohol fuel production.** Evans, J.; McQueary, J. (Evans (Jim), Somerset, KY (USA)). 25 Feb 1983. Contract FG44-80R410311. 6p. NTIS, PC A02/MF A01. Order Number DE84000769.

This is the final report of a project to demonstrate the feasibility of small-scale alcohol fuel production. A list of equipment and costs incurred in contracting the still are included. No experimental results are presented. (DMC)

11692 **Irradiation alcohol fermentation process.** Woo Han, Y. US Patent Application 6-524,178. 17 Aug 1983. 25p.

This invention deals with a novel irradiation process for alcohol fermentation.

11693 **Methanol production by catalytic gasification of wood.** Brown, M.D.; Baker, E.G.; Mitchell, D.H.; Mudge, L.K.; Robertus, R.J. (Pacific Northwest Laboratory, Richland, WA). *American Society of Mechanical Engineers, [Paper]*: 83-PET-33: 6(1983).

The Pacific Northwest Laboratory, through funding by the U. S. DOE, has developed a process to produce methanol from wood or other types of biomass by gasification with steam in the presence of a catalyst. The methanol yield from this process is greater than processes using fixed gasification of wood. The gasification process has been successfully demonstrated in a 25 kg/hr (50 lb/hr) plant. Operating costs and capital expenditures for plants producing between 180 and 1800 MT (100 and 1000 short tons) of methanol per day have been determined. In the gasification process, dry wood in the form of chips or fines is augered into a heated bed of catalyst particles which are fluidized by steam at 700 to 750°C. The wood pyrolyzes producing gases, condensible organic compounds and char. Char is gasified by steam, producing additional hydrogen and carbon monoxide. Condensible organic molecules are cracked by the catalyst, producing more gas. Essentially all organic compounds other than methane are destroyed. The energy for the reaction is provided by heat exchangers in the gasifier. This processing scheme requires no air separation plant and only minimal water treatment facilities. Thus the economics appear promising for plants sized for typical wood resources. In 1982 the development plant was upgraded for operation at 150 psia. The most recent data from pressure operation of the plant are presented. The economics of the process were thoroughly studied in 1980. These cost estimates will be updated to 1982 and they will incorporate any changes in energy requirements and product yields as demonstrated in the gasifier tests at 150 psia. The effect of the plant size versus methanol cost is also discussed.

11694 **Biological conversion system.** Scott, C.D. US Patent Application 6-464,838. [nd]. 12p. Contract W-7405-ENG-26.

A system for bioconversion of organic material comprises a primary bioreactor column wherein a biological active agent (zymomonas mobilis) converts the organic material (sugar) to a product (alcohol), a rejuvenator column wherein the biological activity of said biological active agent is enhanced, and means for circulating said biological active agent between said primary bioreactor column and said rejuvenator column.

0904 Solid Waste And Wood Fuels

11695 **(AD-A—132111/6) Compare: a method for analyzing investment alternatives in industrial wood and bark energy systems. Forest service general technical report.** Ince, P.J. (Forest Products Lab., Madison, WI (USA)). Jun 1983. 30p. NTIS, PC A03/MF A01.

COMPARE is a FORTRAN computer program resulting from a study to develop methods for comparative economic analysis of alternatives in industrial wood and bark energy systems. COMPARE provides complete guidelines for economic analysis of wood and bark energy systems. As such, COMPARE can be useful to those who have only basic familiarity with investment analysis of wood and bark energy systems. This report provides instructions on how to prepare data for COMPARE, information on how to use the program, sample data, sample output, and a listing of the program. COMPARE ranks investment alternatives according to the highest benefit cost ratio based on discounted energy values and cash flows. The use of a benefit cost ratio as a ranking criterion is analyzed and explained in an appendix to this report.

11696 **(DOE/ET/00079—T1) Development and application of material and energy balance regularities for renewable energy resources. Final report.** Erickson, L.E.; Patel, S.A. (Kansas State Univ., Manhattan (USA). Dept. of Chemical Engineering). 1981. Contract FG02-79ET00079. 74p. NTIS, PC A04/MF A01. Order Number DE84005237.

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The characterization of renewable energy resources is necessary in order to make mass and energy balances for processes which use these substances. This work is concerned with the identification of regularities associated with organic compounds and renewable energy resources. The carbon weight fraction, the reductance degree or equivalents of available electrons per gram atom carbon, the heat of combustion per gram equivalent of available electrons, and the free energy of combustion per gram equivalent of available electrons are investigated. Values of these regularities are reported for organic compounds and renewable resources. 31 references, 4 figures, 48 tables.

11697 **(PB—83-262568) Fire safety appraisal of residential wood and coal stoves in New York state. Final report.** Lassoie, J.P.; Provencher, R.W.; Goff, G.R.; Brown, T.L. (Joy Industrial Equipment Co., Los Angeles, CA (USA). Western Precipitation Div.). Apr 1983. 180p. NTIS, PC A09/MF A01.

This study was designed to identify solid fuel (wood and coal) residential heating safety problems and associated causes, and the barriers to correction of these problems in NYS. Based on the research findings, recommendations were developed regarding public and private policies and services, legislation, and financial systems designed to improve the State's solid fuel heating safety situation. Data on solid fuel use was obtained via randomly conducted phone surveys, in-home resident interviews and solid fuel burning system inspections, and a mail survey of fire department chiefs. The most important barriers to safety were those of homeowner complacency (i.e., a sense of security grounded in ignorance -- in the nonpejorative sense) and apathy, with the former being the primary attitudinal barrier. The appendices vol. is the survey used.

11698 **(PB—83-262576) Fire safety appraisal of residential wood and coal stoves in New York state: appendices.** Lassoie, J.P.; Provencher, R.W.; Goff, G.R.; Brown, T.L. (Joy Industrial Equipment Co., Los Angeles, CA (USA). Western Precipitation Div.). Apr 1983. 126p. NTIS, PC A07/MF A01.

Contents: Summary of model building codes; Survey vehicles; Distribution of counties by survey region; Crossley survey statistics; Sampling strategy of fire chief survey; Statewide data weighting process; Safety grade criteria for fifteen safety factors; Demographics of residents using at least some solid fuel; Relationship between relative frequencies of specific safety factors and type of solid fuel heating unit; Likelihood of households currently not heating with solid fuel doing so within the next year.

11699 **(PB—84-103175) Wood and energy in connecticut. Staff report.** Bailey, M.R.; Wheeling, P.R.; Lenz, M.I. (Economic Research Service, Washington, DC (USA). Natural Resource Economics Div.). Mar 1983. 56p. NTIS, PC A04/MF A01.

Telephone surveys of Connecticut households conducted in 1979 indicate a transition to wood heating in response to a series of conventional energy price increases and uncertainty in conventional energy supplies. Connecticut households consumed 668,000 cords of wood in the winter of 1978-79. The airtight wood stove has become the most commonly used wood-burning apparatus. Survey data of residential wood cutting, purchasing, and burning were analyzed by household tenure, wood-burning apparatus, and county. Residential use of wood for energy constitutes a new demand on the forest resource, increases local income and employment, displaces fuel oil and electricity, but may compromise household safety.

0905 Liquid Waste Fuels

11700 **(AD-A—133717/9) Utilization of Navy-generated waste oils as boiler fuel - handbook of guidelines and field survey results. Final report, October 1982-September 1983.** Fu, T.T.; Semien, C. (Naval Civil Engineering Lab., Port Hueneme, CA (USA)). Aug 1983. 62p. (NCEL-TN—1674). NTIS, PC A04/MF A01.

This technical note provides information for a variety of users at different levels of management and operation. Part 1 contains background information on waste oil generation and a survey of waste oil disposition. Part 2 provides pertinent information to Public Works Officers and planners. Topics include: source of waste oil, a survey of disposition of waste oil, restrictions on use as fuel, boiler fuels, air quality considerations, and economics. Part 3 provides procedural information to operators using waste oil as boiler fuel. Waste oil handling, pre-burning treatment, burning methods, equipment modifications, and operational requirements are discussed. Part 4 consists of a comprehensive survey of the potential for utilizing waste oil by Navy/Marine Corps activities and a compilation of the reported experience of waste oil users.

11701 **An update in the development of alternative liquid fuels from spent industrial wastes.** Rose, M.J. (Brookhaven Nat'l Laboratory, Upton, NY 11973). *Energy Technology (Washington, D.C.);* **9**: 1501-1510(Jun 1982). (CONF-820217—).

From 9. energy technology conference; Washington, DC, USA (16 Feb 1982).

Alternative liquid fuels ALF/SUP TM/ have been produced at the Brookhaven Laboratory Central Steam Plant. A pilot processing system utilizing standard hardware has been designed for its use. ALF/SUP TM/ fuels are formulated by "selectively blending" feedstocks of recycled semi-miscible alcohols, and other substandard fuel oils obtained from government surplus. ALF/SUP TM/ is classified as a noncritical, or preferred fuel. It is cost effective, has low sulphur content, burns clean, and provides a safe and acceptable method for the disposal of industrial liquids.

13 HYDRO ENERGY

11702 **(AV-FR—82/594) Monitoring and appraisal evaluation of wind energy potential for electric power generation in the Bristol Bay Area. Final report.** Zambrano, T.G.; Arcemont, G.J. (AeroVironment, Inc., Pasadena, CA (USA)). Feb 1983. Contract AC85-81AP10033. 252p. NTIS MF A01. Order Number DE84004094.

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An analysis has been made of the technical feasibility of developing wind power in the Dillingham/Naknek-King Salmon area of Bristol Bay, Alaska. The analysis involved a survey of historical wind data records, a field study involving ecological indicators such as bush and tree flagging, and a one-year wind monitoring program using data from existing government weather stations as well as anemometers installed by AeroVironment Inc. Finally, a technical analysis was made of expected energy outputs from selected, promising sites. Since Naknek was the most promising site, an energy production calculation for three representative turbines of 25-kW, 65-kW, and 125-kW rating was made. Conclusions are that a 350-kW turbine wind farm with a capacity factor of 0.34 is feasible at Naknek, and that this is the most promising area for wind energy development in the Bristol Bay region.

1303 Plant Design And Operation

REFER ALSO TO CITATION(S) 12190

11703 **(DOE/R4/20006—T54) Brief reconnaissance studies for the addition of hydropower in Puerto Rico.** Gebhard, T.G. Jr. (Gebhard (Thomas G.), Austin, TX (USA)). Oct 1982. Contract AC44-80R420006. 143p. NTIS, PC A07/MF A01. Order Number DE84005509.

Thirteen dams and hydroelectric sites were visited during a four day trip to Puerto Rico in September 1982. Ten brief reconnaissance reports have been prepared to describe the potential at those sites. Information on the remaining three sites - Lago Garzas, Lago Loiza, and Lago Cidra - was insufficient to develop a meaningful report. To develop an insight into the potential for the development and use of hydroelectric power in Puerto Rico, the types of dams were categorized into three types: (1) abandoned hydroelectric sites, (2) dams that have been dedicated for other beneficial uses, and (3) dams that were a part of an active, existing hydroelectric system. Brief reconnaissance reports have been prepared on five abandoned hydroelectric plants, two dams dedicated for other uses, and three active hydroelectric generating plants. All of the hydroelectric plants visited and described appear to be financially feasible for the development of hydroelectric power.

11704 **(DOE/R4/20006—T55) Brief reconnaissance study for the addition of hydropower for Green Brothers Mill Dam, Falls of Rough, Kentucky.** Gebhard, T.G. Jr. (Gebhard (Thomas G.), Austin, TX (USA)). 11 Dec 1982. Contract AC44-80R420006. 20p. NTIS, PC A02/MF A01. Order Number DE84005510.

The following are presented: summary sheet; site description; business data; environmental, institutional, and safety data; plant characteristics and power potential; project economics; and photographs. It was concluded that the development of the full hydroelectric capability of this site is marginally feasible. (MHR)

11705 **(DOE/R4/20006—T56) Brief reconnaissance study for the addition of hydropower for Hyden-Leslie County Water District Dam, Hyden, Kentucky.** Gebhard, T.G. Jr. (Gebhard (Thomas G.), Austin, TX (USA)). 10 Dec 1982. Contract AC44-80R420006. 20p. NTIS, PC A02/MF A01. Order Number DE84005557.

The following are presented: summary sheet; site description; business data; environmental, institutional, and safety data; plant characteristics and power potential; project economics; and photographs. It was concluded that this site does not appear to be economically feasible for the development of hydroelectric power with the assumptions made in this study. (MHR)

11706 **(DOE/R4/20006—T57) Brief reconnaissance study for the addition of hydropower for Townsend Mill and Light Dam, Townsend, Tennessee.** Gebhard, T.G. Jr. (Gebhard (Thomas G.), Austin, TX (USA)). 29 Dec 1983. Contract AC44-80R420006. 18p. NTIS, PC A02/MF A01. Order Number DE84005508.

The following are presented: summary sheet; site description; business data; environmental, institutional, and safety data; plant characteristics and power potential; project economics; and photographs. It was concluded that this site appears to be economically feasible for the development of hydroelectric power. (MHR)

11707 **(DOE/R4/20006—T58) Brief reconnaissance study for the addition of hydropower for Camp Ozone Dam, Ozone, Tennessee.** Gebhard, T.G. Jr. (Gebhard (Thomas G.), Austin, TX (USA)). 28 Dec 1983. Contract AC44-80R420006. 20p. NTIS, PC A02/MF A01. Order Number DE84005512.

The following are presented: summary sheet; site description; business data; environmental, institutional, and safety data; plant characteristics and power potential; project economics; and photographs. It was concluded that it is not economically feasible to develop small-scale hydropower at this dam. (MHR)

11708 **(DOE/R4/20006—T59) Brief reconnaissance study for the addition of hydropower for Shoal Creek Dam No. 2, Lawrenceburg, Tennessee.** Gebhard, T.G. Jr. (Gebhard (Thomas G.), Austin, TX (USA)). 13 Dec 1983. Contract AC44-80R420006. 20p. NTIS, PC A02/MF A01. Order Number DE84005511.

The following are presented: summary sheet; site description; business data; environmental, institutional, and safety data; plant characteristics and power potential; project economics; and photographs. It was concluded that the development of an increased hydroelectric capacity at this site appears to be economically feasible. (MHR)

11709 **(PB—83-251751) Hydraulic model studies on bulb turbine intakes. Technical report.** Pugh, C.A. (Bureau of Reclamation, Denver, CO (USA). Engineering and Research Center). Mar 1983. 26p. (REC-ERC—82-14). NTIS, PC A03/MF A01.

Intakes for bulb and rim generator turbines are very large in relation to their runner diameters. Because the water velocity is low in the intake area, the losses are small. This report describes research on the effect that simplifying the intake design has on energy losses and flow distribution. Using straight surfaces in place of curved bellmouth entrances and shortening the length of the intake could significantly reduce construction costs. In addition, reducing the intake size would reduce the size of trashracks, gates, and associated operating equipment.

14 SOLAR ENERGY

REFER ALSO TO CITATION(S) 12161, 12203

11710 **(ESC-WR—83-23) Report of the working group on solar energy.** Duijves, K.A.; Frikkee, E.; van Gool, W.; Goumans, J.J.J.M.; Joon, K.; Kruijswijk, B.J.; van Tilborg, P.J.; Veringa, H.J. (Stichting Energieonderzoek Centrum Nederland, Petten). Sep 1983. 185p. (In Dutch). ECN, P.O. Box 1, 1755 ZG Petten, Netherlands.

The working group on solar energy of the Netherlands Energy Research Foundation (ECN) presents in this report recommendations for future research and development in the field of solar energy, to be done at the research centre.

1401 Resources And Availability

11711 **(NMERDI—2-71-4517) New Mexico solar and weather design data manual assessment project. Final report.** Fosdick, E.K.; Licht, H.A.; Meilleur, S.G.; Bahm, R.J. (New Mexico Solar Energy Association, Santa Fe (USA)). Nov 1983. 190p. New Mexico Energy Research Development Inst., Information Center, Suite M, 457 Washington SE, Albuquerque, NM 87108.

This report summarizes the results of the New Mexico Solar and Weather Design Data Manual Assessment Project. This was a planning project which sought to identify the best way in which to present a Manual of solar and weather data for New Mexico technical professionals involved in solar energy and related fields. The report presents the results of the three main stages of the project: (1) a data needs assessment and data use analysis of a sample of technical professionals in the state; (2) a review of the existing data bases of solar and weather parameters for New Mexico; and (3) a formulation of recommendations for the presentation and packaging of a manual and supplementary publications. The report also contains a description of the methodology employed in all three stages of the project. This report includes a bibliography of other state solar data manuals.

11712 **Algorithm for evaluating hourly radiation utilizability function.** Clark, D.R.; Beckman, W.A.; Klein, S.A. (Solar Energy Laboratory, University of Wisconsin-Madison, Madison, WI 53706). *American Society of Mechanical Engineers, [Paper];* **82-WA/SOL-19:** 7(1982). (CONF-821101—).

From ASME winter annual meeting (Engineering applications of laser velocimetry/published in ASME Jr. Fluid Engineering); Phoenix, AZ, USA (14 Nov 1982).

A computationally simple algorithm is presented for evaluating the hourly utilizability function, /phi/, defined as the fraction of the long-term monthly-average hourly solar radiation incident on a surface which exceeds a specified threshold intensity. The hourly utilizability approach can be used for any azimuth and allows a different threshold intensity to be defined for each hour of the day. If needed, daily utilizability for any orientation can be found by summing results over a day. Hourly results are shown to compare favorably both with an analytical expression for /phi/ developed recently and with results obtained from many years of hourly horizontal radiation measurements.

11713 **Material-resource implications of solar deployment, 1980-2000.** Schiffman, Y.M. (MITRE Corp., McLean, VA). pp 31-35 of Proceedings of the IASTED energy symposia: modelling, policy and economics of energy and power systems; alternative energy sources and technology. Hamza, M.H. (ed.). Anaheim, CA; ACTA Press (1981). (CONF-810574—).

From International Association of Science and Technology for Development energy symposium; San Francisco, CA, USA (20 May 1981).

The Technology Assessment of Solar Energy (TASE) Systems sponsored by the US Department of Energy includes an examination of the material resource consraints and hazardous and toxic waste impacts of solar technology deployment during the period 1980 to 2000. The recently completed TASE materials-resource studies conclude that solar deployment could seriously affect the supply of copper, glass, steel, concrete, and aluminum. With the exception of passive-solar designs, solar systems have a much greater finished materials' requirement than either biomass or conventional energy systems. Manufacturing or indirect pollution hot spots could result near and after the year 2000 where industrial growth occurs for materials-intensive solar technologies. Further, TASE studies conclude that some toxic materials could be introduced into the environment unless more benign substitutes are found. This paper reviews the TASE material resource studies. It covers the future availability of materials, domestic production and capacity, slowdown of US materials production and cost of imports, increased foreign dependence on certain materials and minerals, and substitutions of material resources. 2 figures, 3 tables.

1403 Economics

11714 **(DOE/JPL/1012—93) Probabilistic analysis of silicon cost.** Reiter, L.J. (Jet Propulsion Lab., Pasadena, CA (USA)). 15 Nov 1983. Contract AI01-76ET20356. 23p. (JPL-PUB—83-94). NTIS, PC A02/MF A01. Order Number DE84005741.

Silicon materials costs represent both a cost driver and an area where improvement can be made in the manufacture of photovoltaic modules. This study analyzes the cost from three processes for the production of low-cost silicon being developed under the US Department of Energy's (DOE) National Photovoltaic Program. The approach is based on probabilistic inputs and makes use of two models developed at the Jet Propulsion Laboratory: SIMRAND (SIMulation of Research ANd Development) and IPEG (Improved Price Estimating Guidelines). The approach, assumptions, and limitations are detailed in the study along with a verification of the cost analyses methodology. The results are presented in the form of cumulative probability distributions for silicon cost. These results indicate that there is a 55% chance of reaching the DOE target of $16/kg for silicon material. This is a technically achievable cost based on expert forecasts of the results of ongoing research and development and do not imply any market prices for a given year.

11715 **An analysis of the cost/performance characteristics of passive solar materials and components.** Sullivan, P.; Cremans, A.H.; Oswald, R.; Shingleton, J.G. (Enersource, Washington, DC). *Proceedings, Intersociety Energy Conversion Engineering Conference;* 3: 1573-1577(Aug 1982). (CONF-820814—).

From 17. Intersociety Energy Conversion Engineering conference; Los Angeles, CA, USA (8 Aug 1982).

The paper presents the results of an extensive analysis performed for the Department of Energy for use in passive program planning activities. The results presented are performance to cost ratios for a variety of passive features. The ratios provide an economically based criterion on which to base design decisions. Ratios were developed for 19 applications, each in 3 climatic regions: cold (Madison, Wisconsin); hot and dry (Phoenix, Arizona); and hot and humid (Lake Charles, Louisiana). Commercial and residential applications of passive features are considered in this study. To determine the performance of the materials and components two thermal network simulation programs were utilized. Base case residential and commercial building descriptions are included. The performance of a passive feature is considered to be the decrease in energy consumption by the base case building due to the inclusion of the passive feature. Incremental passive feature costs are compared to incremental passive feature performance.

11716 **Photovoltaic balance of system.** Stolte, W.J. (Bechtel Group, Inc., San Francisco, CA). pp 124-128 of Proceedings of the IASTED energy symposia: modelling, policy and economics of energy and power systems; alternative energy sources and technology. Hamza, M.H. (ed.). Anaheim, CA; ACTA Press (1981). (CONF-810574—).

From International Association of Science and Technology for Development energy symposium; San Francisco, CA, USA (20 May 1981).

This paper addresses the balance of system (BOS) for photovoltaic power systems. Major cost items are identified and discussed. Factors influencing the design and cost of BOS equipment as well as other cost items are also discussed. Emphasis is on large power systems and major BOS cost items. 4 references, 4 figures, 1 table.

11717 **Socio-economic impacts of solar deployment and conventional energy use.** Gordon, J.J.; Tahami, J.E. (MITRE Corp., McLean, VA). pp 129-133 of Proceedings of the IASTED energy symposia: modelling, policy and economics of energy and power systems; alternative energy sources and technology. Hamza, M.H. (ed.). Anaheim, CA; ACTA Press (1981). (CONF-810574—).

From International Association of Science and Technology for Development energy symposium; San Francisco, CA, USA (20 May 1981).

The technology assessment of Solar Energy Systems (TASE), sponsored by DOE, includes an investigation of the environmental and socio-economic impacts of solar-technology utilization. This paper is based on a portion of this project and discusses the impact for 1978 and 1990 on disposable personal income of solar deployment compared to conventional fuel use. Households most severely affected by high energy prices are identified, as well as those households best able to reduce energy costs through the purchase of solar energy and conservation equipment. Low-income groups spend a disproportionately large share of their budgets to satisfy household energy needs, as compared to the national average. This situation is not projected to improve by 1990. In 1978, solar technologies offered no cost advantage to households as compared to use of electricity. In 1990, wood heating and passive-solar heating appear to offer slight advantages, while solar hot water tends to require about the same fraction of personal income as electric hot water. Solar tax credit and collector sales data show that solar implementation is proceeding at a steady pace. However, because of their high initial cost, solar systems are seldom accessible to low-income households unless financial assistance is offered. 10 references, 4 figures, 2 tables.

11718 **Decision rule for the installation of a solar-electric system.** Orren, L.H.; Chamberlain, R.G. (California Inst. of Tech., Pasadena). pp 134-137 of Proceedings of the IASTED energy symposia: modelling, policy and economics of energy and power systems; alternative energy sources and technology. Hamza, M.H. (ed.). Anaheim, CA; ACTA Press (1981). (CONF-810574—).

From International Association of Science and Technology for Development energy symposium; San Francisco, CA, USA (20 May 1981).

This paper addresses the question of when a user should install a solar-electric system to provide electricity which would otherwise be purchased from the grid. The basic result is that it should be installed when the beginning real levelized cost of solar equals the price of grid electricity. This result is derived analytically and then compared to other suggested rules. 1 reference, 2 figures.

1404 Environmental, Legal, And Institutional Aspects

REFER ALSO TO CITATION(S) 11713, 11762, 11763, 11764, 11765, 11766, 11767, 12202, 12415

11719 **(DOE/CS/30627—T1) Model solar energy document. Final report.** (National Association of Counties Research, Inc., Washington, DC (USA)). 30 Sep 1982. Contract FG01-81CS30627. 95p. NTIS, PC A05/MF A01. Order Number DE84004730.

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The National Association of Counties Research, Inc. undertook to provide consulting services to the Council of American Building Officials in support of the Model Solar Energy Document for the period of June 1, 1980 through September 30, 1980. A brief report is given of each of the original tasks and those undertaken under work plan modifications. A number of appendices are attached to this report.

11720 **(DOE/SF/11573—T1-Vol.1) Active Program Research Requirements (APRR). Final report. Volume I.** Scholten, W.B.; Morehouse, J.H. (Science Applications, Inc., McLean, VA (USA). Energy Systems Group). 31 Oct 1983. Contract AC03-81SF11573. 137p. NTIS, PC A07/MF A01. Order Number DE84002141.

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With the advent of tightened solar energy development budgets, DOE's Active Solar Program saw the need for an examination of its projects, with a focus on identifying long-term, high-risk research and development activities. The Active Program Research Requirements (APRR) project was initiated to provide that examination. This report describes the methodology adopted for the APRR and presents the results of applying that methodology to the initial set of year 2000 systems. Section 3 outlines the methodology used in the APRR project. The material is presented to establish a foundation for the process and assumptions used in determining cost goals and the ranking procedure. Section 4 describes the APRR process as it was applied in this project. Descriptions are provided concerning the project organization and participants, how the system level selection/identification process was conducted, how component plans were generated, and how the ranking/scoring procedure was implemented. The raw results of the APRR process are presented here. Section 5 examines the results generated by the APRR process. The raw results are analyzed in terms of system/subsystem requirement, the component plans, and the ranking of the projects. General elements of the APRR process are combined and/or broken-up here in order to gain insights into why some of the results appear as they do. Section 6 discusses those results which have implications for the Active Solar Program. Additionally, the perceived shortcomings of the APRR process and the Active Program are examined in light of the results. Finally, how the APRR process can continue to aid the Active Program is presented.

11721 **(LBL—14555) Ecology of Hawaiian marine mammals emphasizing the impact of Ocean Thermal Energy Conversion (OTEC) on endangered species.** Payne, S.F.; Hartwig, E.O. (Lawrence Berkeley Lab., CA (USA)). Jun 1982. Contract W-7405-ENG-48. 42p. NTIS, PC A03/MF A01. Order Number DE84004405.

Twenty-two marine mammal species including 2 baleen whales, 20 toothed whales, and one pinniped occur in Hawaiian waters. Among these are two endangered species, the migratory humpback whale (Megaptera novaengliae) around the main islands, and the non-migratory Hawaiian monk seal (Monachus schauinslandi) in the extreme northwestern island chain. The endangered species are among those most commonly sighted, while spinner dolphins (Stenella spp.), bottle-nosed dolphins (Tursiops sp.), and false killer whales (Pseudorca crassidens) are sighted less frequently. Most Hawaiian cetacean species are Odontoceti, or toothed whales, and feed on fish and squid. The Mysteceti or baleen whales feed on plankton, however the endangered humpback whale, which migrates to Hawaii to breed and calve, presumably does not feed there. The endangered monk seal feeds on cephalopods and fish. The impact of OTEC on endangered and non-endangered marine mammals results from several direct and indirect effects and is discussed in the text. Careful siting of OTEC plants away from humpback breeding areas and monk seal breeding and feeding areas will avoid adverse effects on these populations.

1405 Solar Energy Conversion

REFER ALSO TO CITATION(S) 11677, 11680, 11682, 11683, 11686, 11687, 11690, 11691, 11693, 11694, 11695, 11699, 11714, 11757, 12200, 12205, 12423, 12424, 12536, 12761, 12762, 12763, 12764, 12765, 12766, 12767, 12769, 12778, 12812

11722 **(AD-A—133951/4) Polarization effects in the luminescence of cadmium selenide electrodes. Technical report.** Streckert, H.H.; Van Ryswyk, H.; Biagioni, R.N.; Ellis, A.B. (Wisconsin Univ., Madison (USA). Dept. of Chemistry). 29 Sep 1983. 22p. NTIS, PC A02/MF A01.

Polarization properties of the emission from single-crystal, n-type CdSe samples have been examined. When excited with several ultrabond gap wavelengths, a-plates of n-CdSe (wurtzite structure) exhibit polarized photo-luminescence (PL) spectra consistent with the reported electronic structure of the solid. The spectra consist of two bands near the band gap energy (approximately 1.7 eV), assignable to transitions between the conduction band and a split valence band having its two highest-energy band edges separated by approximately 0.022 eV; the lower-energy band is preferentially polarized with E is perpendicular toc while the other band displays no polarization preference. Time-resolved PL data, obtained with 620-nm excitation from a N2-pulsed dye laser, were independent of polarization. Intensity-time curves yielded a decay time (t sub l/e) of approximately 20 ns for both bands, providing evidence that the two emissive excited states are in thermal equilibrium. Emissive properties of n-CdSe, a-plate electrodes were also consistent with thermal equilibration. Polarized electroluminescence (EL) spectra, obtained using the solid as a dark cathode in aqueous peroxydisulfate electrolyte, closely resemble their PL counterparts, demonstrating attainment of similar excited-state populations in the two experiments. And when the semiconductor is used as the photoanode of a photoelectrochemical cell employing diselenide electrolyte, the two PL bands resulting from 514.5- or 632.8-nm excitation are quenched in parallel by the electric field present in the semiconductor.

11723 **(DOE/CS/66001—1) ECUT Energy Conversion and Utilization Technologies Program. Chemical Processes Project annual report, FY 1982.** Wilcox, R.E. (comp.). (Jet Propulsion Lab., Pasadena, CA (USA)). 1 Jul 1983. Contract AI01-81CS66001. 46p. (JPL-PUB—83-58). NTIS, PC A03/MF A01. Order Number DE84005796.

The Chemical Processes Project was one of six projects comprising the US Department of Energy (DOE) Energy Conversion and Utilization Technologies (ECUT) Program during fiscal year 1982. The Project was established in May 1980 to investigate and develop new techniques and reaction sequences for the chemical processing industry. In fiscal year 1982, the Project supported three major areas of research: Catalyst Modeling; Biocatalysis; and Separation. Catalyst Modeling research concentrates on developing models for predicting and optimizing the reactivity of major heterogeneous catalysts. Biocatalysis research focuses on resolving the major technical barriers that impede the potential use of biologically-facilitated continuous chemical production processes. Separation research focuses on establishing the technical feasibility of innovative, low energy intensive separation concepts. In late 1982, the ECUT Program was reorganized. The Chemical Processes Project was consolidated and renamed the Biocatalysis Research Activity. In fiscal year 1983, Biocatalysis is the primary research focus. Cata-

lyst Modeling activities, now called Molecular Modeling, are continued but focused on supporting Biocatalysis research. Program descriptions and 1982 accomplishments in each area are summarized.

11724 **(DOE/CS/83106—T1) Deep traps in AlGaAs layers at AlGaAs-GaAs interfaces. Final technical report.** Portnoy, W.M. (Texas Tech Univ., Lubbock (USA). Dept. of Electrical Engineering). 1 Oct 1983. Contract FG02-80CS83106. 14p. NTIS, PC A02/MF A01. Order Number DE84005234.

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Deep trapping levels in the AlGaAs layer near the AlGaAs-GaAs interface are characterized using deep level transient spectroscopy, thermally stimulated capacitance measurements, forward current-voltage characteristics, and capacitance vs. reverse-bias voltage taken at different temperatures. (LEW)

11725 **(DOE/CS/83110—T1) Sensitization of photovoltaic cells by energy transfer. Final technical report.** Boyd, R.W.; Castner, T.G.; Knox, R.S. (Rochester Univ., NY (USA)). 31 Mar 1982. Contract FG02-80CS83110. 5p. NTIS, PC A02/MF A01. Order Number DE84005233.

An expression was obtained for the highly efficient transfer of excitation energy to electron-hole pair states in a semiconductor from molecules outside the semiconductor and not in contact with its surface. Progress in the experimental work includes: assembly of a clean high-vacuum system for the evaporation of organics on semiconductor surfaces; making arrangements to prepare solar cell geometry samples using photolithography; preliminary optical fluorescence studies. (LEW)

11726 **(DOE/CS/83114—T1) Innovative concepts for photovoltaic applications. Final technical report.** Litt, M.H.; Gordon, W.L. (Case Western Reserve Univ., Cleveland, OH (USA)). Dec 1983. Contract FG02-80CS83114. 4p. NTIS, PC A02/MF A01. Order Number DE84005247.

The work reported here is directed toward the construction of photovoltaic devices from polymeric materials based on crystalline carbazole or acridone substituted poly(N-acyl ethyleneimines). In the carbazole case the concept was to deposit electron acceptors or a second electron accepting polymer on their surface to generate a p-n junction. Synthesis of the carbazole and acridone side chain monomers has been accomplished and low molecular weight polymer prepared for both materials. Crystallization studies demonstrated the need for a plasticizer in both polymers, particularly for the carbazole polymer where T/sub g/ and T/sub m/ are very close. A charge transfer complex of the carbazole polymer with TCNQ was prepared, forming as a black precipitate from solution in dioxane. The dioxane is involved in the crystalline phase, presumably through the effects of packing geometry. ESR shows a relatively large free spin concentration which does not take part in electrical conduction. Powder compactions show significantly better conductivity than do semicrystalline case films of the polymer alone but we conclude that a much stronger electron donor must be used in place of the carbazole in order to approach the desired conductivity.

11727 **(DOE/CS/84063—1) New photochemical systems for harvesting photon energies. Final report.** Demas, J.N. (Virginia Univ., Charlottesville (USA). Dept. of Chemistry). 1981. Contract FG02-80CS84063. 24p. NTIS, PC A02/MF A01. Order Number DE84005275.

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A trapping system based on the reactions in a Hg^{2+} system is described. To demonstrate the potential utility of the Hg^{2+}/Hg_2^{2+} system for harvesting excited state energies, a $[Ru(bpy)_3]^{2+}/Hg^{2+}$ based photogalvanic cell was constructed. The chemistry and spectroscopy of the Hg(II)-Ru(II) systems are examined. (LEW)

11728 **(DOE/JPL—1012-90) Characterization of grain boundaries in silicon.** Cheng, L.J.; Shyu, C.M.; Stika, K.M.; Crotty, G.T. (Jet Propulsion Lab., Pasadena, CA (USA)). 15 Nov 1983. Contract AI01-76ET20356. 49p. (JPL-PUB—83-87). NTIS, PC A03/MF A01. Order Number DE84005747.

Results from several research activities on properties of grain boundaries in silicon materials are reported. Zero-bias conductance and capacitance measurements at various temperatures were used to study trapped charges and potential barrier height at the boundaries. Deep-level transient spectroscopy (DLTS) was applied to measure the density of states at the boundary. The result is consistent with the model in which the density of states increases as the states become deeper. Anomalous phenomena have been observed by DLTS and other methods, which can be only explained by a new model in which the spatial distribution of the localized states is not uniform along the boundary in the microscopic scale. A study of photoconductivity of grain boundaries in p-type silicon demonstrated the applicability of the technique in the measurement of minority carrier recombination velocity at the grain boundary. The data are consistent with the concept of recombination velocity increasing with boundary-state density and light intensity. Enhanced diffusion of phosphorus at grain boundaries in three cast polycrystalline photovoltaic materials was studied. Enhancements for the three were the same, indicating that the properties of boundaries are similar, although grown by different techniques. Grain boundaries capable of enhancing the diffusion were found always to have strong recombination activities; the phenomena could be related to dangling bonds at the boundaries. The present study gives the first evidence that incoherent second-order twins of [111]/[115] type are diffusion-active.

11729 **(DOE/JPL/1012—91) Chemical bonding technology for terrestrial photovoltaic modules. Status to February 1983.** Coulter, D.R.; Cuddihy, E.F.; Plueddeman, E.P. (Jet Propulsion Lab., Pasadena, CA (USA)). 15 Nov 1983. Contract AI01-76ET20356. 61p. (JPL-PUB—83-86). NTIS, PC A04/MF A01. Order Number DE84005612.

Encapsulated photovoltaic modules must hold together for 20 years, reliably resisting delamination and separation of any of the component materials. Delamination of encapsulation materials from each other, or from solar cells and interconnects, can create voids for accumulation of water, promoting corrosive failure. Delamination of silicone elastomers from unprimed surfaces was a common occurrence with early modules, but the incidences of silicone delamination with later modules decreased when adhesion promoters recommended by silicone manufacturers were used. An investigation of silicone delamination from unprimed surfaces successfully identified the mechanism, which was related to atmospheric oxygen and moisture. This early finding indicated that reliance on physical bonding of encapsulation interfaces for long life in an outdoor environment would be risky. For long outdoor life, the material components of a module must therefore be held together by weather-stable adhesion promoters that desirably form strong, interfacial chemical bonds. The Environmental Isolation Task of the Flat-Plate Solar Array Project (FSA), managed by the Jet Propulsion Laboratory (JPL) for the US Department of Energy (DOE), conducts a program to identify, develop, and validate weather-stable chemical bonding adhesion promoters for terrestrial photovoltaic modules. This report is intended to accomplish three purposes: provide a status report on chemically bonding adhesion promoters, with data on bond strength performance; describe and discuss the theories of the chemically bonded interface; and identify processing considerations relevant to achieving long-term interfacial chemical bonding.

11730 **(DOE/JPL/955089—83/17) Silicon solar cell process development, fabrication, and analysis. Thirteenth quarterly report, 1 March 1983-30 June 1983.** Leung, D.C.; Iles, P.A. (Optical Coating Lab., Inc., City of Industry, CA (USA). Photoelectronics Div.). 1983. Contract NAS-7-100-955089. 20p. NTIS, PC A02/MF A01. Order Number DE84005864.

In this reporting period, measurements of minority carrier diffusion lengths were made on the small mesa diodes from HEM Si and SILSO Si. The results were consistent with previous Voc and Isc measurements. Only the medium grain SILSO had a distinct advantage for the non-grain boundary diodes. Substantial variations were observed for the HEM ingot 4141C. Also a quantitatively scaled light spot scan was being developed for localized diffusion length measurements in polycrystalline silicon solar cells. A change to a more monochromatic input for the light spot scan re-

sults in greater sensitivity and in principle, quantitative measurement of local material qualities is now possible.

11731 **(DOE/JPL/955843—84/12) Large-area sheet task advanced dendritic web growth development. Annual report, October 23, 1982-October 22, 1983.** Duncan, C.S.; Seidensticker, R.G.; McHugh, J.P. (Westinghouse Research and Development Center, Pittsburgh, PA (USA)). 13 Jan 1984. Contract NAS-7-100-955843. 59p. NTIS, PC A04/MF A01. Order Number DE84006049.

The thermal models used for analyzing dendritic web growth and calculating the thermal streas were reexamined to establish the validity limits imposed by the assumptions of the models. Also, the effects of thermal conduction through the gas phase were evaluated and found to be small. New growth designs, both static and dynamic, were generated using the modeling results. Residual stress effects in dendritic web were examined. In the laboratory, new techniques for the control of temperature distributions in three dimensions were developed. A new maximum underformed web width of 5.8 cm was achieved. A 58% increase in gowth velocity at 150 μm thickness was achieved with dynamic hardware. The area throughput goals for transient growth of 30 and 35 cm^2/min were exceeded.

11732 **(DOE/R6/10954—T1) Solid-state solar tracker, actuator and motor development.** Ray, E.D. (Ray (Edward D.), Lawton, OK (USA)). [nd]. Contract FG46-79R610954. 128p. NTIS, PC A07/MF A01. Order Number DE84003546.

Portions are illegible in microfiche products.

Disclosed is a method and means for direct conversion of solar energy to mechanical energy through alternate warming and cooling of material consisting of highly aligned, high density polymer molecules. A strip of said material, when warmed by any means, contracts along its axis of alignment and such contraction can do mechanical work in a way mechanically similar to muscular contraction. A plurality of such strips mounted upon a rotor does work against gravity; the gravity field than returns the energy as torque. This material is referred to as Solar Muscle. An instrument was designed and built to measure power output of Solar Muscle. Various samples were obtained. Results of several measurement runs are attached. Solar trackers of several designs were developed, built, and tested. Successful solar tracking using twisted and wrapped SM was demonstrated. Actuators of several designs were developed, built, and tested. Since current SM conversion efficiency of solar energy directly to mechanical form was about two percent of one percent, power production per se must await an improved plastic. However, small actuator motors using polyethelene SM should be useful now.

11733 **(PB—83-248682) Heat release rate properties of wood-based materials.** Chamberlain, D.L. (National Forest Products Association, Washington, DC (USA)). Jul 1983. 92p. NTIS, PC A05/MF A01.

A background to the present heat release rate calorimetry is presented. Heat release rates and cumulative heat release were measured for 16 different lumber and wood products, using three different heat release rate instruments. The effects of moisture content, exposure heat flux, density of product, and fire retardant on rate of heat release were measured. The three small-scale heat release rate calorimeters were compared, and equations relating the data from each were developed.

11734 **(PB—84-100767) Chemicals from wood: the policy implications of federal subsidy. Volume 1. Executive summary.** Johnson, R.C.; Miller, C.G.; Neuworth, M.B.; Talib, A. (Mitre Corp., McLean, VA (USA). METREK Div.). Jan 1983. 73p. (MTR—83W9-01). NTIS, PC A04/MF A01.

The policy implications involving the production of ethanol, furfural, and phenol from the breakdown of wood and the production of methanol and acetic acid from wood gasification are examined. A market analysis is combined with an engineering and discounted flow cash analysis to project the need for selective subsidies. The aggregate demand for wood and the displacement of petrochemical feedstocks are analyzed. It is found that the production of large-scale industrial chemicals from wood is technically and economically feasible and that the principal barrier is the perceived risk associated with wood as a feedstock. The policy issues of Federal supports for chemicals from biomass are discussed. Reviewer comments are appended to the report.

11735 **(PB—84-100775) Chemicals from wood: the policy implications of federal subsidy. Volume 2. Analysis and conclusions.** Johnson, R.C.; Miller, C.G.; Neuworth, M.B.; Talib, A. (Mitre Corp., McLean, VA (USA). METREK Div.). Jan 1983. 269p. (MTR—83W9-02). NTIS, PC A12/MF A01.

This report addresses the policy implications involving the production of ethanol, furfural, and phenol from the breakdown of wood, and methanol and acetic acid from wood gasification. The selection process for high value-added chemicals from biomass is examined, and the primary and secondary screening criteria are considered. The projected levels of market penetration for the five chemicals from wood are summarized, the principal petrochemical feedstocks that would be displaced are noted, and the critical uncertainties in the projections are explored. Ethanol from wood is said to be competitive with synthetic ethanol for approximately half the total chemical market for ethanol. Furfural is likely to be coproduced with ethanol from wood; it is predicted that additional markets for furfural will open up if the price of furfural decreases. The production of phenol is shown to be one option for the use of the lignin fraction of wood. The policy issues of Federal supports for chemicals from biomass are analyzed. Reviewer comments are appended to the report.

11736 **(PB—84-104660) Marine biomass program annual report, 1982.** Tompkins, A.N. (General Electric Co., Philadelphia, PA (USA). Advanced Energy Programs Dept.). Mar 1983. 449p. NTIS, PC A19/MF A01.

This report provides the details of the research and development activities performed on the Marine Biomass Program by the General Electric Company and its team of associates for the Gas Research Institute. The work performed during this period was, for the most part, a continuation of the research program started in 1981. The primary objective of this project at the start of work in January 1982 was to obtain harvestable yield data at the Goleta Nearshore Test Facility and at the Catalina Test Facility. In support of this objective, a significant body of data was derived from both test facilities. This included: Evaluation of the growth capabilities of individual plants with subsequent identification and selection of high yielding plants; insight into the relationship between kelp productivity, water temperature, solar radiation and nutrition; successful demonstration of planting techniques that can be developed into high rate planting systems; determination of effects of pulse versus continuous fertilization of kelp; and critical preliminary data on the effect of nutritional history on tissue levels of the highly biodegradable kelp constituent mannitol. The data base was incorporated into a comprehensive system specification which served as a base line for an independent economic analysis.

11737 **(PB—84-104892) In vitro chlorophyll photosynthetic reaction. Annual report Jan-Dec 83.** Fong, F.K.; Alfano, A.J.; Showell, M.S. (Purdue Univ., Lafayette, IN (USA). Dept. of Chemistry). Aug 1983. 71p. NTIS, PC A04/MF A01.

This research project attempts to reconstitute the photosynthetic mechanism using elementary constituents of in vivo photosystems. The purpose is to unravel the mechanisms of plant photosynthesis. An array of new experimental results was obtained making use of various instrumental methods: (1) Electron spin resonance and photogalvanic current measurements provide evidence for a particularly effective contribution from a dimeric aggregate of hydrated chlorophyll to in vitro photosynthetic activity; (2) Gas chromatographic and ion cyclotron resonance measurements support the in vitro photosystem's ability to catalyze water splitting; (3) Fluorescence lifetime measurements were made to examine the excited singlet and triplet paths of the hydrated chlorophyll aggregates; (4) From the observation of oscillatory delayed fluorescence in monomeric hydrated chlorophyll it has been concluded that the smallest hydrated Chl a complex capable of photocatalyzing water splitting is a dimer.

11738 **(PB—84-121185) Stabilization of photoactive complexes formed between pigments and proteins. Final report.** Sironval, C.; Collard, F.; Jeanfils, J. (Commission of the European Communities, Luxembourg). [nd]. 69p. (In French). (EUR—7541-FR). NTIS, PC E04/MF E04.

With a view to utilizing the photo-biochemically active components of green plants in vitro in a bioreactor by converting solar energy into stored chemical energy for eventual use in the production of hydrogen, the preservation of photo-synthetic activities of chloroplasts for a period comparable with their practical utilization has been assessed. Short and long-term effects of the fixation of glutaraldehyde on membranous structures have been evaluated by examining the functions and forms of the protein-pigment complexes.

11739 **(SAND—82-7131) Design and development of a stand-alone concentrator photovoltaic array. Final report.** (General Electric Co., Philadelphia, PA (USA). Advanced Energy Programs Dept.). Nov 1983. Contract AC04-76DP00789. 135p. NTIS, PC A07/MF A01. Order Number DE84005860.

The design and development of a new Stand-Alone concentrating photovoltaic array is described. Array sizing, tracking structure and controls have been tailored for use in semi-remote non-grid connected applications. A new tracking approach has been developed that uses commercially available components, can be transported by small truck or trailer, and can be erected by two semi-skilled workers. The 684 watt array incorporates six 114 watt point-focus, flat Fresnel modules. Array level testing at GE has demonstrated an average array efficiency of 14% at direct normal insolations between 727 to 776 w/m^2 normalized to a 28°C cell temperature.

11740 **(SAND—83-2323C) Operation and maintenance experience in photovoltaic (PV) arrays.** Harrison, T.D.; Fernandez, J.P. (Sandia National Labs., Albuquerque, NM (USA); New Mexico Univ., Albuquerque (USA). Engineering Research Inst.). 1983. Contract AC04-76DP00789. 7p. NTIS, PC A02/MF A01. Order Number DE84005517.

This paper presents strategies and costs for operation and maintenance (O and M) for two fixed, flat-plate PV arrays. A survey of all PRDA 38 fixed, flat-plate PV arrays shows that the strategies for conducting O and M are generally similar but costs vary somewhat. A PV array is that part of a PV system that comprises the modules, the support structure, and the wiring necessary for transmission of electrical power to the load and for grounding. The two arrays selected are Beverly High School (Massachusetts) and Lovington Square Shopping Center (New Mexico). They were selected because they are operating in a steady-state condition and are very similar. Both arrays use the same modules (Solar Power Model G12-361-CT). They are both part of a 100-kW system, both systems were designed by the same architectural and engineering (A and E) firm (Stone and Webster), both comprise two subsystems, both use 75-kW Helionetics Power Conditioning Subsystems (PCSs) to convert dc power to ac power, and both feed power to the grid through isolation transformers. The differences in the arrays are that the one at Beverly High School has 3200 modules in 40 subarrays, compared with 3,360 modules in 42 subarrays at Lovington, Beverly is in a more northerly latitude (42.67°) than Lovington (32.56°), and there is more precipitation at Beverly than at Lovington.

11741 **(SERI/TP—215-2049) Meteorologic/atmospheric effects on the performance of solar photovoltaic energy conversion devices.** Hulstrom, R.L. (Solar Energy Research Inst., Golden, CO (USA)). Jul 1983. Contract AC02-77CH00178. 7p. (CONF-831069—4). NTIS, PC A02/MF A01. Order Number DE84000018.

From 5. conference on atmospheric radiation; Baltimore, MD, USA (31 Oct 1983).

The purpose of this paper is to highlight and summarize those meteorologic/atmospheric effects on the performance of solar photovoltaic energy conversion devices (and systems). Areas of performance considered will include the production of electricity, cost, reliability, and predictably. All of these areas, as discussed above, impact the ability of photovoltaic devices, systems, and power plants to eventually become a significant source of electricity for the United States. In addition, this paper will identify the pertinent meteorologic, atmospheric, and solar radiation data required to ensure the proper research, development, design, application, and operation of photovoltaic devices, systems, and power plants.

11742 **Process for high photocurrent in IBC solar cells.** Sexton, F.W.; Garner, C.M.; Rodriguez, J.L. (Sandia National Laboratories, Albuquerque, NM). *Journal of the Electrochemical Society;* **129**: No. 11, 2624-2628(Nov 1982).

An interdigitated back contact solar cell fabrication process that yields cells with current-collection efficiencies in excess of 90% in n-type silicon is presented. This process maintains high bulk minority-carrier lifetime through the use of diffusion gettering steps and relatively low processing temperatures. Low front and back surface recombination velocities are achieved by growing thermal oxides on these surfaces followed by a forming gas anneal. Bulk lifetimes on the order of 350 μsec and front surface recombination velocities of less than 30 cm/sec are determined by comparing measured quantum efficiency data to calculated quantum efficiency using an analytical code which solves the transport equations in one dimension. These lifetimes are compared to values of 290-190 μsec measured for cells with and without a front surface n^+ layer, respectively. These were measured with a laser scanning technique using the 514 nm wavelength and are considered a lower limit to the lifetimes.

11743 **A microprocessor-controlled suntracker and load controller for photovoltaic concentrator array power systems.** Pritchard, D.A. (Sandia National Laboratories, Albuquerque, NM). *Conference Record of the IEEE (Institute of Electrical and Electronics Engineers) Photovoltaic Specialists Conference;* 611-615(Sep 1982). (CONF-820906—).

From 16. IEEE photovoltaics specialists conference; San Diego, CA, USA (28 Sep 1982).

This paper describes the design, development, and evaluation of a microcomputer-based solar tracking and control system (TACS) for a photovoltaic (PV) concentrator array. The TACS combines the function of sun tracking with the function of load adjustment for peak array efficiency. The complete PV array is used as the sun sensor. The TACS minimizes tracking errors caused by dust and dirt on shadow-band tracking systems, and minimizes the effects of structural warpage and sag that may occur in large arrays. A single-board computer with a specially designed input/output board controls array positioning by an orderly method of stepped movements and finds the peak power point by scanning the current-voltage curve of the array. The TACS was tested using a small two-axis tracking concentrator array. Test results show a deviation in maximum power of less than 1% during the day after accounting for other variations.

11744 **Grain boundary structure and properties in polycrystalline silicon.** Tsuo, Y.S.; Hardy, R.W.; Milstein, J.R. (Solar Energy Research Institute, Golden, CO). *Conference Record of the IEEE (Institute of Electrical and Electronics Engineers) Photovoltaic Specialists Conference;* 616-621(Sep 1982). (CONF-820906—). Contract AC02-77CH00178.

From 16. IEEE photovoltaics specialists conference; San Diego, CA, USA (28 Sep 1982).

Recent advances in studying the grain boundary properties of polycrystalline silicon solar cell materials are reviewed. Of particular importance are the recent improvements in hydrogen grain boundary passivation techniques that have not only shortened the required passivation treatment time to only a few minutes but also demonstrated the ability to significantly increase polycrystalline silicon solar cell efficiencies for both large-grained and small-grained materials.

11745 **Grain boundaries in silicon solar cells.** Kazmerski, L.L.; Dick, J.R.; Herrington, C.R.; Ireland, P.J.; Jones, K.M.; Matson, R.J.; Russell, P.E. (Solar Energy Research Institute, Golden, CO). *Conference Record of the IEEE (Institute of Electrical and Electronics Engineers) Photovoltaic Specialists Conference;* 622-626(Sep 1982). (CONF-820906—). Contract AC02-77CH00178.

From 16. IEEE photovoltaics specialists conference; San Diego, CA, USA (28 Sep 1982).

The correlations between the electrical and compositional properties of grain boundaries in polycrystalline Si are examined in detail. High-resolution surface analysis techniques (AES, SIMS, XPS, EELS) and microelectrical (SAM, EBIC, minority-carrier lifetime) characterization methods are used. The direct evidence for impurity segregation to the intergrain regions is presented. Effect of illumination on the grain boundary electrical characteristics are correlated with impurity compositions. Finally, the interrelationships among heat-treatment, oxygen segregation and grain boundary electrical activity are discussed.

11746 **Test data analysis and results for concentrating photovoltaic modules.** Edenburn, M.W. (Sandia National Laboratories, Albuquerque, NM). *Conference Record of the IEEE (Institute of Electrical and Electronics Engineers) Photovoltaic Specialists Conference;* 669-674(Sep 1982). (CONF-820906—).

From 16. IEEE photovoltaics specialists conference; San Diego, CA, USA (28 Sep 1982).

In this paper the authors present an expression for efficiency that is a linear function of cell temperature and illumination. They use this expression to correlate test data for concentrating photovoltaic modules. The linear form of the equation is justified by showing that it derives from a cell model that considers the cell to be a parallel current source and diode in series with a resistance. The linear expression has been used to correlate test results for a variety of concentrating modules. Results for those modules that are currently the most promising and interesting to the photovoltaic community are presented in the paper.

11747 **Photovoltaic concentrator progress.** Boes, E.C. (Sandia National Laboratories, Albuquerque, NM). *Conference Record of the IEEE (Institute of Electrical and Electronics Engineers) Photovoltaic Specialists Conference;* 702-712(Sep 1982). (CONF-820906—).

From 16. IEEE photovoltaics specialists conference; San Diego, CA, USA (28 Sep 1982).

This paper gives a brief but comprehensive summary of the status of photovoltaic concentrator technology. It includes a discussion of various concentrator concepts; a report on the experiences of 6 experimental PV concentrator array fields; test results on more recent PV concentrator module designs; a discussion of data analysis tools; new results on concentrator component development; a discussion of the solar resource differences for flat plate and concentrating collectors; and a discussion of cost analyses and price targets for this technology.

11748 **Update of pulsed-laser processing technology for high-efficiency silicon solar cells.** Young, R.T.; Van Der Leeden, G.A.; Westbrook, R.D.; Wood, R.F. (Oak Ridge National Laboratory, Oak Ridge, TN). *Conference Record of the IEEE (Institute of Electrical and Electronics Engineers) Photovoltaic Specialists Conference;* 748-751(Sep 1982). (CONF-820906—). Contract W-7405-ENG-26.

From 16. IEEE photovoltaics specialists conference; San Diego, CA, USA (28 Sep 1982).

Recent advances in the pulsed laser processing of silicon solar cells are described. These include the use of a XeCl laser to avoid the need for the beam homogenizers and substrate heating used with solid state lasers, the further development of low-cost gaseous discharge implantation equipment, and the use of P-diffusion for back surface field formation instead of laser damage gettering followed by laser-induced diffusion of antimony.

11749 **Initial formation and development of CdS/$CuInSe_2$ solar cell interfaces.** Kazmerski, L.L.; Ahrenkiel, R.K.; Hermann, A.; Ireland, P.J.; Jamjoum, O.; Matson, R.J.; Russell, P.E. (Solar Energy Research Institute, Golden, CO). *Conference Record of the IEEE (Institute of Electrical and Electronics Engineers) Photovoltaic Specialists Conference;* 786-790(Sep 1982). (CONF-820906—). Contract AC02-77CH00178.

From 16. IEEE photovoltaics specialists conference; San Diego, CA, USA (28 Sep 1982).

Fundamental properties of interface formation in the CdS and Cd(Zn)S/$CuInSe_2$ solar cell are investigated using surface analysis and microelectrical characterizations. The formation of a binary semiconductor transition layer during the initial stages of heterojunction growth is reported. The effects of annealing on the integrity of the various device interfaces and the performance of the cells are discussed. The evaluation of heterojunction and electrical response at other internal interfaces is studied using high resolution EBIC on fractured cell cross-sections. The importance and effects of post-deposition oxygen heat-treatments on the cell performance are discussed.

11750 **A p-i-n heterojunction model for the thin film $CuInSe_2$/CdS solar cell.** Rothwarf, A. (Electrical and Computer Engineering Department, Drexel University, Philadelphia, PA 19104). *Conference Record of the IEEE (Institute of Electrical and Electronics Engineers) Photovoltaic Specialists Conference;* 791-793(Sep 1982). (CONF-820906—).

From 16. IEEE photovoltaics specialists conference; San Diego, CA, USA (28 Sep 1982).

By treating the high resistivity CdS and $CuInSe_2$ layers in high efficiency cells as insulating, a simple p-i-n model results that predicts the behavior seen in these cells. The relatively low open circuit voltage and the diode factor are both directly related to the width of the insulating CdS layer. Substantial improvements in both V/SUB oc/ and fill factor can be expected if the width of this CdS layer can be reduced.

11751 **Series resistance associated with thick-film contacts to solar cells.** Firor, K.; Barrett, J.M.; Coyle, R.T.; Hogan, S.J. (Solar Energy Research Institute, Golden, CO). *Conference Record of the IEEE (Institute of Electrical and Electronics Engineers) Photovoltaic Specialists Conference;* 824-827(Sep 1982). (CONF-820906—). Contract AC02-77CH00178.

From 16. IEEE photovoltaics specialists conference; San Diego, CA, USA (28 Sep 1982).

A high series resistance is often associated with thick-film contacts on solar cells. This paper presents a study of the thick-film silver/silicon interface of a single-crystal silicon solar cell. Series and contact resistance measurements and scanning electron microscopy, in conjunction with hydrofluoric acid etching of cells, lead toward an understanding of the silver/silicon interface and of the barriers to current flow.

11752 **Reduction of photovoltaic cell reverse breakdown by a peripheral bypass diode.** Cox, C.H.; Mountain, R.W.; Silversmith, D.J. (Massachusetts Institute of Technology, Lincoln Laboratory, Lexington, Massachusetts). *Conference Record of the IEEE (Institute of Electrical and Electronics Engineers) Photovoltaic Specialists Conference;* 834-839(Sep 1982). (CONF-820906—).

From 16. IEEE photovoltaics specialists conference; San Diego, CA, USA (28 Sep 1982).

A photovoltaic cell in a series-connected string can be forced to operate in a power-dissipation mode when the cell's short-circuit current is reduced below the string current as a result of cracking or shadowing. New techniques for significantly reducing the power dissipated are reported based on locating protection for the cell around its periphery. One approach uses a standard diode, thereby requiring no additional processing; the other approach uses a backward diode, which requires one additional doping step. Theoretical considerations and experimental results are presented. Initial devices yield a power-dissipation reduction of more than a factor of 10 with the backward diode and over 30 for the standard diode. It is found that the standard diode requires a slight increase in cell-interconnect complexity while the backward diodes uses conventional interconnections.

11753 **Progress in polycrystalline thin-film photovoltaic device research: the DOE/SERI program.** Hermann, A.M.; Fabick, L.; Hardy, R.; Zweibel, K. (Solar Energy Research Institute, Golden, CO). *Conference Record of the IEEE (Institute of Electrical and Electronics Engineers) Photovoltaic Specialists Conference;* 840-845(Sep 1982). (CONF-820906—). Contract AC02-77CH00178.

From 16. IEEE photovoltaics specialists conference; San Diego, CA, USA (28 Sep 1982).

Recent results from the United States Department of Energy (DOE) Thin-Film Photovoltaic Device Program are presented. The program which is managed by the Solar Energy Research Institute (SERI) encompasses materials and device research on highly absorbing compound semiconductors including cuInSe$_2$, CdTe, Cu / SUB 2-x/ Se, Zn_3P_2, $ZnSiAs_2$, and Cu_2S. Excitement in the program has been generated by recent progress in the (Cd,Zn)S/ $CuInSe_2$ device area where an efficiency of 10.6% on a 5 μm thick device has been reported. Other highlights include deposition of a hybrid CdS/Cu_2S device (evaporated CdS, sputtered Cu_2S) with a 7.1% AM1 efficiency, and of a 3.94% AM1 efficiency all-sputtered CdS/Cu_2S cell. AM1 efficiencies exceeding 5% are reported for CdTe Schottky barrier and heterojunction devices, and for a CdS/ Cu /SUB 2-x/ Se heterojunction. AM1 efficiencies exceeding 4% are reported for Mg/Zn_3P_2 Schottky barrier cells. Future research emphasis is outlined.

11754 **Solar cell contacts.** Meier, D.L.; Campbell, R.B.; Davis, J.R.; Rai-Choudhury, P.; Sienkiewicz, L.J. (Westinghouse, Advanced Energy Systems Division, Pittsburgh, PA). *Conference Record of the IEEE (Institute of Electrical and Electronics Engineers) Photovoltaic Specialists Conference;* 904-910(Sep 1982). (CONF-820906—).

From 16. IEEE photovoltaics specialists conference; San Diego, CA, USA (28 Sep 1982).

Two experimental contact systems were examined and compared to a baseline contact system consisting of evaporated layers of titanium, palladium, and silver and an electroplated layer of copper. The first experimental contact system consisted of evaporated layers of titanium, nickel, and copper and an electroplated layer of copper. This system performed as well as the baseline system in all respects, including its response to temperature stress tests, to a humidity test, and to an accelerated aging test. In addition, the cost of this system is estimated to be only 43% of the cost of the baseline system at a production level of 25 MW/year. The second experimental contact system consisted of evaporated layers of nickel and copper and an electroplated layer of copper. Cells with this system show serious degradation in a temperature stress test at 350°C for 30 minutes. Auger Electron Spectroscopy was used to show that the evaporated nickel layer is not an adequate barrier to copper diffusion even at temperatures as low as 250°C. This fact brings into question the longterm reliability of this contact system.

11755 **Estimation of magnitude and frequency of occurrence of high cell temperatures in reverse bias.** Lambarski, T.J. (The BDM Corporation, Albuquerque, NM). *Conference Record of the IEEE (Institute of Electrical and Electronics Engineers) Photovoltaic Specialists Conference;* 1020-1024(Sep 1982). (CONF-820906—).

From 16. IEEE photovoltaics specialists conference; San Diego, CA, USA (28 Sep 1982).

Under reverse bias conditions caused by partial shadowing (hot spot heating), cell temperatures in typical modules can exceed 150°C. These temperatures may produce severe out-gassing or discoloration to the point of early failure or, in the absence of failure, repeated occurrence of high cell temperature could produce long term degradation. Also, the development of modules from advanced PV technologies could introduce new materials with lower temperature degradation thresholds. Therefore, the following analysis was performed to assess the temperature rise of a cell in a typical module under worst-case shadowing and the frequency of occurrence of high cell temperatures during the year. The former was determined by hand calculations; the latter was obtained using the SOLCEL II code specially modified to accept reverse bias on the cell. This paper first determines the worst-case temperature for cells with different shunt resistances in bypass groups of different lengths. Next, the models for implementation into SOLCEL II and the required modifications to SOLCEL II are explained. Then the results are presented in charts of daily highs and lows and histograms of temperature occurrence for the entire year. Finally, the implications of the results are assessed.

1406 Photovoltaic Power Systems

REFER ALSO TO CITATION(S) 11716, 11741, 12536

11756 **(DOE/ET/20356—8) Value of residential photovoltaic systems: a comprehensive assessment.** Borden, C.S. (Jet Propulsion Lab., Pasadena, CA (USA)). 15 Sep 1983. Contract AI01-76ET20356. 102p. (JPL-PUB—83-63). NTIS, PC A06/MF A01. Order Number DE84005609.

Utility-interactive photovoltaic (PV) arrays on residential rooftops appear to be a potentially attractive, large-scale application of PV technology. Results of a comprehensive assessment of the value (i.e., break-even cost) of utility-grid connected residential photovoltaic power systems under a variety of technological and economic assumptions are presented. A wide range of allowable PV system costs ($1 to $3 per peak watt) are calculated for small (4.34 kW/ ac) residential PV systems in various locales across the United States. Primary factors in this variation are differences in local weather conditions, utility-specific electric generation capacity, fuel types, and customer-load profiles that affect purchase and sell-back rates, and non-uniform state tax considerations. Additional results from this analysis are: locations having the highest insolation values are not necessarily the most economically attractive sites; residential PV systems connected in parallel to the utility demonstrate high precentages of energy sold back to the grid, and owner financial and tax assumptions cause large variations in break-even costs. Significant cost reduction and aggressive resolution of potential institutional impediments (e.g., liability, standards, metering, and technical integration) are required for a residential PV market to become a major electric-grid-connected energy-generation source.

11757 **New designs and installations of photovoltaic array fields with low balance-of-system costs.** Post, H.N. (Sandia Nat'l Laboratories, Albuquerque, NM 87185). *Energy Technology (Washington, D.C.);* **10**: 1402-1410(Jun 1983). (CONF-830213—).

From 10. energy technology conference; Washington, DC, USA (28 Feb 1983).

This paper describes the design, development, and prototype installation of low-cost, modular array fields for flat-plate photovoltaic (PV) systems. Key features of the array field balance-of-system (BOS) components including structures, foundations, intermodule connection, field wiring, and system grounding are identified. Cost projections for the two alternative building-block array-field designs which have been developed show a significant reduction in the BOS costs compared to that experienced in previous PV installations. Prototype array fields of each design have been installed in the Sandia Test Facility. Installation costs of these fields are emphasized in this paper.

11758 **Application of power transistors to residential and intermediate rating photovoltaic array power conditioners.** Steigerwald, R.L.; Ferraro, A.; Turnbill, F.G. (Corp. Research and Devel. Dept., General Electric Co., P.O. Box 43, Schenectady, NY 12301). *IEEE (Institue of Electrical and Electronics Engineers) Transactions on Industry Applications;* **1A**: No. 2, 254-267(Mar 1983). Contract AC02-80ET29310.

An investigation into power conditioners that interface with photovoltaic arrays and utilities has been recently completed. The ratings for this investigation include residential systems (5-30 kW) that interface with a 240-V single-phase utility connection and intermediate systems (30-200 kW) that interface with a 480-V three-phase utility connection. Both systems mandated that an isolation transformer be provided between the array and the utility interface. A trade-off study was performed for many transistor and thyristor circuits and configurations. The weighting criteria included full- and part-load efficiency, size, weight, reliability, ease of control, injected harmonics, reactive power requirements, and parts cost. As the result of this study, a 10-kW high-frequency PWM transistor inverter feeding a high-frequency isolation transformer with a sinusoidally shaped current wave was selected. The output of the transformer is rectified with a diode bridge rectifier. Four thyristors, used as 60-Hz switches, reverse the polarity of the rectified current on every other half-cycle of the utility voltage. This reversal is ac-

complished slightly before the natural zero crossing of the voltage, thereby providing commutation for the thyristors. The results in the intermediate rating study targeted on a 100-kW design using power transistors in a full-bridge circuit connected to a 60-Hz three-phase transformer.

1407 Solar Thermal Power Systems

REFER ALSO TO CITATION(S) 11804

11759 (CONF-821055—, pp 7-31) **4-95 solar Stirling engine: a progress report.** Holgersson, S.; Percival, W.H. Apr 1983. NTIS, PC A16/MF A01.

From 20. automotive technology development contractors' coordination meeting; Dearborn, MI, USA (25 Oct 1982).

The Stirling engine is shown to be an ideal choice for a solar plant. Solar dish systems are described and the elements of module efficiency are given. The United Stirling 4-95 engine background and the four required solar modifications are described, including lubrication system, induction alternator, control system and receiver. Past and present solar dish programs are outlined and recent solar engine test results from Georgia Tech and Edwards, CA are given. An overall module efficiency of 27.8% was achieved. Finally, manufacture cost estimates are presented.

11760 **(DOE/JPL/1060—63) Solar parabolic dish annual technology evaluation report. Fiscal year 1982.** (Jet Propulsion Lab., Pasadena, CA (USA)). 15 Sep 1983. Contract AT04-81AL16228. 35p. (JPL-PUB—83-73). NTIS, PC A03/MF A01. Order Number DE84005610.

This report summarizes the activities of the JPL Solar Thermal Power Systems Parabolic Dish Project for FY 1982. Included are discussions on designs of module development including their concentrator, receiver, and power conversion subsystems. Analyses and test results, along with progress on field tests, Small Community Experiment System development, and tests at the Parabolic Dish Test Site are also included.

11761 **(DOE/SF/10501—003) Final environmental impact assessment/environmental impact report. 10 Megawatt solar power pilot plant.** (Environmental Improvement Agency of San Bernardino County, CA (USA)). Jun 1978. Contract FC03-77SF10501. 403p. (STMPO—063). NTIS, PC A18/MF A01. Order Number DE84004788.

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This report includes the following chapters: Report summary; project characteristics; project description; environmental setting; summary of adverse and beneficial environmental effects; the relationship between short-term use of resources and long-term productivity; irreversible environmental changes, irretrievable commitment of resources; site restoration; growth-inducement characteristics; alternatives to the proposed project; environmental tradeoff analysis; and detailed analysis: natural environmental resources.

11762 **(DOE/SF/10501—137) Solar One Visitor Center.** (Environmental Improvement Agency of San Bernardino County, CA (USA)). Jul 1983. Contract FC03-77SF10501. 8p. (STMPO—737). NTIS, PC A02/MF A01. Order Number DE84004535.

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A report of the attendance, special events, outside presentations, and news releases for the month of July 1983, is presented.

11763 **(DOE/SF/10501—138) Solar One Visitor Center.** (Environmental Improvement Agency of San Bernardino County, CA (USA)). Aug 1983. Contract FC03-77SF10501. 7p. (STMPO—738). NTIS, PC A02/MF A01. Order Number DE84004536.

A report on the attendance, special events, ouside presentations, and news releases for the month of August 1983, is presented.

11764 **(DOE/SF/10501—139) Solar One Visitor Center.** (Environmental Improvement Agency of San Bernardino County, CA (USA)). Sep 1983. Contract FC03-77SF10501. 8p. (STMPO—739). NTIS, PC A02/MF A01. Order Number DE84004786.

A report on the attendance, special events, outside presentations, and news releases for the month of September 1983, is presented.

11765 **(DOE/SF/10501—140) Solar One Visitor Center.** (Environmental Improvement Agency of San Bernardino County, CA (USA)). Oct 1983. Contract FC03-77SF10501. 8p. (STMPO—740). NTIS, PC A02/MF A01. Order Number DE84004784.

A report on the attendance, special events, outside presentations, and news releases for the month of October 1983, is presented.

11766 **(DOE/SF/10501—141) Solar One Visitor Center.** (Environmental Improvement Agency of San Bernardino County, CA (USA)). Nov 1983. Contract FC03-77SF10501. 8p. (STMPO—741). NTIS, PC A02/MF A01. Order Number DE84004800.

A report of the attendance, special events, outside presentations, and news releases for the month of November 1983, is presented.

11767 **(DOE/SF/10501—142) Solar One Visitor Center.** (Environmental Improvement Agency of San Bernardino County, CA (USA)). Dec 1983. Contract FC03-77SF10501. 8p. (STMPO—742). NTIS, PC A02/MF A01. Order Number DE84004801.

A report on the attendance, special events, outside presentations, and news releases for the month of December 1983, is presented.

11768 **(DOE/SF/10501—305) Solar One.** (Environmental Improvement Agency of San Bernardino County, CA (USA)). [nd]. Contract FC03-77SF10501. 12p. (STMPO—605). NTIS, PC A02/MF A01. Order Number DE84004537.

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This brochure describes the 10 MWe Solar Thermal Central Receiver Pilot Plant near Barstow, California. The Barstow pilot plant, also known as Solar One, is a scale model of a 100-megawatt electric generating plant. Although Solar One can supply the electric requirements for a community of 6000, its major purpose is to provide information and data for future power plants and other users of high-quality energy. As a research and development facility, it will move solar-powered electric generation plants closer to operational feasibility.

11769 **(DOE/SF/11675—T1-Vol.1) Preliminary design of a solar central receiver for a site-specific repowering application (Saguaro Power Plant). Volume 1. Executive summary. Final report, October 1982-September 1983.** Weber, E.R. (Arizona Public Service Co., Phoenix (USA)). Sep 1983. Contract FC03-82SF11675. 48p. NTIS, PC A03/MF A01. Order Number DE84005128.

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The preliminary design of a solar central receiver repowered gas/oil fired steam-Rankine cycle electric power generation plant was completed. The design is based on a central receiver technology using molten salt (60% $NaNO_3$, 40% KNO_3, by weight) for the heat transport and thermal storage fluid. Unit One of APS's Saguaro power plant located 43 km (27 mi) northwest of Tucson, AZ, is to be repowered. The selection of both the site and the molten salt central receiver promotes a near-term feasibility demonstration and cost-effective power production from an advanced solar thermal technology. The recommended system concept is to repower the existing electric power generating system at the minimum useful level (66 MW/sub e/ gross) using a field of 4850 Martin Marietta second-generation (58.5 m^2) heliostats and a storage capacity of 4.0 hours. The storage capacity will be used to optimize dispatch of power to the utility system. The preliminary design was based on the use of the systems approach to design where the overall project was divided into systems, each of which is clearly bounded, and performs specific functions. The total project construction cost was estimated to be 213 million in 1983 dollars. The plant will be capa-

ble of displacing fossil energy equivalent to 2.4 million barrels of No. 6 oil in its first 10 years of operation.

11770 **(DOE/SF/11675—T1-Vol.2) Preliminary design of a solar central receiver for site-specific repowering application (Saguaro Power Plant). Volume II. Preliminary design. Final report, October 1982-September 1983.** Weber, E.R. (Arizona Public Service Co., Phoenix (USA)). Sep 1983. Contract FC03-82SF11675. 437p. NTIS, PC A19/MF A01. Order Number DE84005129.

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The solar central receiver technology, site, and specific unit for repowering were selected in prior analyses and studies. The objectives of this preliminary design study were to: develop a solar central receiver repowering design for Saguaro that (1) has potential to be economically competitive with fossil fueled plants in near and long term applications, (2) has the greatest chance for completion without further government funding, (3) will further define technical and economic feasibility of a 66 MWe gross size plant that is adequate to meet the requirements for utility and industrial process heat applications, (4) can potentially be constructed and operated within the next five years, and (5) incorporates solar central receiver technology and represents state-of-the-art development. This volume on the preliminary design includes the following sections: executive summary; introduction; changes from advanced conceptual design; preliminary design; system characteristics; economic analysis; and development plan.

11771 **(DOE/SF/11675—T1-Vol.3) Preliminary design of a solar central receiver for a site-specific repowering application (Saguaro Power Plant). Volume III. Specifications. Final report, October 1982-September 1983.** Weber, E.R. (Arizona Public Service Co., Phoenix (USA)). Sep 1983. Contract FC03-82SF11675. 330p. NTIS, PC A15/MF A01. Order Number DE84005130.

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This volume on specifications for the Saguaro Power Plant includes the following: subsystem interface definition document; solar collector subsystem specification; receiver specification; thermal energy storage specification; solar steam generator specification; and master control system specification.

11772 **(DOE/SF/11675—T1-Vol.4) Preliminary design of a solar central receiver for a site-specific repowering application (Saguaro Power Plant). Volume IV. Appendixes. Final report, October 1982-September 1983.** Weber, E.R. (Arizona Public Service Co., Phoenix (USA)). Sep 1983. Contract FC03-82SF11675. 809p. NTIS, PC A99/MF A01. Order Number DE84005131.

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The appendixes for the Saguaro Power Plant includes the following: receiver configuration selection report; cooperating modes and transitions; failure modes analysis; control system analysis; computer codes and simulation models; procurement package scope descriptions; responsibility matrix; solar system flow diagram component purpose list; thermal storage component and system test plans; solar steam generator tube-to-tubesheet weld analysis; pipeline listing; management control schedule; and system list and definitions.

11773 **(DOE/SF/11675—T1-Vol.5) Preliminary design of a solar central receiver for a site-specific repowering application (Saguaro Power Plant). Volume V, drawings. Final report, October 1982-September 1983.** Weber, E.R. (Arizona Public Service Co., Phoenix (USA)). Sep 1983. Contract FC03-82SF11675. 192p. NTIS, PC A09/MF A01. Order Number DE84005132.

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Drawings for the components and systems of the Suguaro Power Plant are included in this volume.

11774 **(DOE/SF/11677—T1-Vol.1) El Paso Electric Company Newman Unit 1 Solar Repowering preliminary design. Final report, Volume 1.** (El Paso Electric Co., TX (USA)). Nov 1983. Contract FC03-82SF11677. 421p. NTIS, PC A18/MF A01. Order Number DE84005363.

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This report discusses the preliminary design for the Newman Unit 1 Solar Repowering, El Paso Electric Company (EPE). The solar repowering concept utilizes central receiver technology and consists of the addition of a solar collector field (movable mirrors to direct sunlight to the receiver), a central receiver (solar boiler and superheater), the integration of the solar hardware with the existing systems; and appropriate modifications to the existing unit. The ability to operate on fossil fuel is retained, thus providing full backup capability and maximum operational flexibility during periods of inclement weather, at night, or during power emergencies. The preliminary design phase produced a technical design with a solar receiver with heating surface contained in external panels for economizer, evaporation, and superheat duty. A separate shell and tube type reheater is included, using superheated steam as a heating fluid. These represent revisions to the previous studies and are based on economic analyses and on considerations for reliability and flexibility of operation. A rigorous computer simulation addresses the problems of transient heat flux due to passing clouds that rapidly reduce and rapidly restore the solar heat source. The analysis indicated that the large heat storage contained in the receiver and the long runs of superheat steam piping, combined with use of electronic controls and sliding pressure operation, mitigate the effects of rapid transients. Based on this work, it appears that hybrid water/steam central receiver power generating systems can be designed to satisfy electric utility operational requirements.

11775 **(DOE/SF/11677—T1-Vol.2) El Paso Electric Company Newman Unit 1 Solar Repowering preliminary design. Final report, Volume 2.** (El Paso Electric Co., TX (USA)). Nov 1983. Contract FC03-82SF11677. 446p. NTIS, PC A19/MF A01. Order Number DE84005364.

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This volume consists of seven appendices detailing the results of the preliminary design studies for Newman Unit 1 solar repowering program. Appendix A gives a description of system alternative, subsystem analysis results, and characteristics of preferred system. Appendix B gives the design requirements. Appendix C gives a description of work including capital cost and receives cost estimate. Appendix D gives reliability analysis results. Details of fossil and solar simulation models are given in Appendix E. Appendix F reports on the receiver superheater hot tube analysis. Receiver design and performance details are given in Appendix G.

11776 **(DOE/SF/11677—T1-Vol.3) El Paso Electric Company Newman Unit 1 Solar Repowering preliminary design. Final report, Volume 3.** (El Paso Electric Co., TX (USA)). Nov 1983. Contract FC03-82SF11677. 401p. NTIS, PC A18/MF A01. Order Number DE84005365.

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Volume 3 consists of the following appendices: heliostate technical specification; state highway relocation drawings; Stone and Webster Engineering Corporation (SWEC) flow diagrams; SWEC system descriptions; SWEC drawings; collector field studies; preliminary foundation report; and conceptual pipe stress analysis report.

11777 **Recent developments in central receiver systems.** Skinrood, A. (Sandia National Laboratories, Livermore, CA). *Sunworld;* 6: No. 4, 98-100(Aug 1982).

This article reports on the 6 major international central receiver projects, as discussed at the International Workshop on the Design, Construction, and Operation of Solar Central Receiver Projects. Describes Eurelios, a central receiver project located in Sicily; the Themis Plant, a 2000 kWe solar central receiver power plant in southern France; Project Sunshine, an experimental central receiver electrical generating plant located on the island of Shikoku, Japan; a 10-megawatt solar thermal central receiver pilot plat

at Barstow, California; the Small Solar Systems Project in southern Spain; and CESA-1, a 1200 kWe plant located near Almeria, Spain.

1408 Ocean Energy Systems

REFER ALSO TO CITATION(S) 11721, 11823, 12415, 12416

11778 (CONF-840201—6) Design of the near shore seawater systems for an OTEC expanded test facility. Genens, L.; Stevens, H. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 4p. NTIS, PC A02/MF A01. Order Number DE84004043.

From ASME energy sources technology conference and exhibition; New Orleans, LA, USA (12 Feb 1984).

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Argonne National Laboratory (ANL) is preparing a design for expanded test facilities at the Seacoast Test Facility site, Keahole Point, Hawaii. Specific effort has been placed on the design of the near-shore/on-shore seawater systems. The seawater systems consist of a warm-water supply, a cold-water supply, a mixed discharge, and a land-based pumping station. Test facilities are planned that will utilize this thermal energy resource. This resource consists nominally of 1600 kg/s (25,000 gpm) of cold water and 4200 kg/s (65,000 gpm) of warm surface water, which will be used to support heat-exchanger and system tests and, with a turbine added, could produce a net power for the validation of closed- and open-cycle models now in planning at ANL and the Solar Energy Research Institute (SERI).

11779 (DOE/ET/21055—T3) Development, design, fabrication and testing of ocean thermal energy conversion (OTEC), power system development (PSD) II. Volume IV. Detailed drawings. Preliminary design report. (General Electric Co., Schenectady, NY (USA)). Jul 1979. Contract AC01-78ET21055. 94p. NTIS, PC A05/MF A01. Order Number DE83015170.

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Detailed drawings of the 10 MWe power module and the heat exchanger for the OTEC-10 power plant are presented.

11780 (PB—83-257022) Ocean energy systems at the Johns Hopkins University Applied Physics Laboratory, January - March 1983. Quarterly report. (Johns Hopkins Univ., Laurel, MD (USA). Applied Physics Lab.). 1983. 27p. NTIS, PC A03/MF A01.

The Johns Hopkins University Applied Physics Laboratory, under a contract with the U.S. Department of Energy's Division of Ocean Energy Technology (DOE/DOET), is engaged in developing Ocean Thermal Energy Conversion (OTEC) systems that will provide synthetic fuels (e.g., methanol), energy-intensive products such as ammonia (for fertilizers and chemicals), and aluminum. The work also includes assessment and design concepts for hybrid plants, such as geothermal-OTEC (GEOTEC) plants. APL has been designated the Lead Laboratory in these areas by DOE/DOET. Another effort that began in the spring of 1982 is a technical advisory role to DOE with respect to their management of the conceptual and preliminary design activity of industry teams that are designing a shelf-mounted offshore OTEC pilot plant that could deliver power to Oahu, Hawaii. In addition, the Laboratory is now taking part in a program to evaluate and test the Pneumatic Wave-Energy Conversion System (PWECS), an ocean-energy device consisting of a turbine that is air-driven as a result of wave action in a chamber. This Quarterly Report summarizes the work on the various tasks as of 31 March 1983.

11781 Performance and stability of the mist lift process for open-cycle OTEC. Davenport, R.L.; Johnson, D. (Solar Energy Research Institute, Golden, CO). *American Society of Mechanical Engineers, [Paper]*; **82-WA/SOL-23**: 13(1982). (CONF-821101—).

From ASME winter annual meeting (Engineering applications of laser velocimetry/published in ASME Jr. Fluid Engineering); Phoenix, AZ, USA (14 Nov 1982).

This paper presents the results of SERI's analytical studies of the mist lift process for open-cycle OTEC. Results of a multiple-drop-size model that considers collisions and coalescence of drops indicate that drop growth is rapid. Results from an improved model that includes breakup of drops as well as coalescence indicate that drops tend to grow rapidly to a mean diameter of about 0.5 mm and that collisions prevent the drops from growing much larger than a few millimetres. Parametric studies performed using a single-drop-size model have indicated that the mist life process will perform under a variety of conditions. Important considerations for the design of a mist lift tube have also been identified as a result of these studies. Results of a transient mist life model indicate that the mist flow process is stable to perturbations in operating conditions, as long as the conditions remain within the steady-state operational envelope for the particular mist lift tube under study.

1409 Solar Thermal Utilization

REFER ALSO TO CITATION(S) 11715, 11720, 11802, 11803, 12144, 12144, 12202, 12221, 12244, 12248, 12249

11782 (CAPE—2923) Solar Heating Demonstration Project. Final report (Engineering Materials). (Louisiana State Univ., Baton Rouge (USA)). 27 Sep 1982. Contract AC03-76CS32391. TIC, PO Bx 62, Oak Ridge, TN 37831.

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This final report is a summary of the chronology, conditions, procedures, and results of an effort to demonstrate a commercially available solar heating system for space and water heating of the Louisiana State University Field House. Reference DOE/CS/32391—T1.

11783 (DOE/CS/22003—T3) 1980 Design + energy national student design competition. Schluntz, R.; Smeallie, P.; Vonier, T. (Association of Collegiate Schools of Architecture, Washington, DC (USA)). Sep 1980. Contract FG01-80CS22003. 5p. NTIS, PC A02. Order Number DE84005704.

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The recently held DESIGN + ENERGY Student Design Competition is explained, detailing the program, the design problems, the resource materials and the evaluation criteria. The first place winning submissions are presented with comments from the competition's jurors. An assessment of the program and its effect on architecture education is given.

11784 (DOE/CS/30524—1) Thermal gain shutter control. Final report, preliminary design phase. Kuzdrall, J.A. (Intrel Service Co., Nashua, NH (USA)). 1 Oct 1983. Contract FC02-80CS30524. 82p. NTIS, PC A05/MF A01. Order Number DE84004438.

The Thermal Gain Sensor is an insulation control system for manual and motorized solar shutters. Unlike ordinary systems, control is based on the actual net thermal flow through the window, rather than a tenuous or indirect measure. The sensor continuously and directly tracks the conduction, convection, and radiation losses as well as the attenuated solar input. Although basically simple and inexpensive, the Thermal Gain Sensor (TGS) reacts to the thermal flow with near perfect accuracy. It operates with equal effectiveness in both summer and winter. The hardware consists of a sensor, a control box, and an optional power controller for motorized shutters. The first objective of the preliminary design phase was to determine if, with properly selected materials and dimensions, a practical sensor could accurately determine the real thermal gain threshold under the wide range of installations, geographic locations, and weather conditions. The second objective, having found the best possible sensor design, was to determine whether the level of performance attainable produced significantly more energy savings than competitive control systems, namely time and sunlight activated systems. Another objective of this phase was to assure that the product could be made for an acceptable cost. To this end, a schematic design, including conceptual drawings, was prepared. From this conceptual design, manufacturing cost estimates were made using industry accepted estimating procedures. Finally, it was required to determine whether there was public interest in the

product. For this, a preliminary assessment of the market was made, based on unsolicited inquiries and local discussions.

11785 **(DOE/CS/30634—3) Simulation and design of passive processes. Progress report, February-August 1983.** (Wisconsin Univ., Madison (USA). Solar Energy Lab.). Nov 1983. Contract FG02-81CS30634. 5p. NTIS, PC A02/MF A01. Order Number DE84004056.

In general terms, progress has been good during this reporting period. The study of meteorological statistics is nearing completion. We have working TRNSYS models of thermosyphon water heaters of two basic types, those with separate collector and storage tank, and the breadbox type with combined collector-storage. Several design methods have been explored for these systems, with none yet producing fully satisfactory results. Excellent progress has been made in understanding the relationships between active and passive heating systems and a very satisfactory method has been developed for modifying the f-chart design method for active heating systems in buildings which have a significant part of their heating loads supplied by passive methods. A new study of energy flows in buildings is now under way; it is too early for definitive results to be forthcoming. The study of meteorological statistics is producing useful results.

11786 **(DOE/R5/10220—T1) Solar and energy conservation retrofit of Central Fire Station No. 1: a high visibility, public demonstration, training, and education program. Final technical report.** Arnold, L.A. (Fort Wayne, City of, IN (USA). City Utilities Operations). 30 Nov 1983. Contract FG02-80R510220. 77p. NTIS, PC A05. Order Number DE84005257.

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. This project set out to accomplish three goals in furthering the concepts of appropriate energy technology in Fort Wayne: (1) to provide a highly visible public demonstration project of an energy conservation and hybrid solar energy retrofit; (2) to conduct a hands-on training experience for members of the Fort Wayne Fire Department in energy conservation and solar energy building techniques; (3) to educate homeowners, school children, business and local government officials about appropriate energy technology applications such as a passive solar energy retrofit. This project was a very ambitious solar and energy conservation retrofit of Fire Station No. 1 owned by the City of Fort Wayne. The grant award was made in September of 1980 with the project completed by August 31, 1983. A number of modifications to the proposed construction project were made to both improve the design and expected performance as well as to abide by budget constraints. Although the project experienced significant construction delays it has been completed and is regarded as a valued enhancement to the central business district and a symbol of Fort Wayne's commitment to renewable energy development and utilization.

11787 **(DOE/R6/12028—T1) Concilio central thermal storage/convective air wall project. Final report.** (New Mexico Solar Energy Association, Santa Fe (USA)). 28 Mar 1983. Contract FG46-80R612028. 6p. NTIS, PC A02/MF A01. Order Number DE84003121.

The construction of six Trombe walls and/or convective air walls for two low-income residences and four high school buildings is reported. The project was considered successful in providing a significant amount of heat and in promoting interest for future community development.

11788 **(DOE/R6/12324—T1) Carrizozo Recreation Center. Final report.** (Carrizozo, Town of, NM (USA)). [nd]. Contract FG46-81R612324. 6p. NTIS MF A01. Order Number DE84004066.

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A brief report is given on the construction and installation of a solar heating system for the Carrizozo Recreational Center. It is conclude. that an analysis of the effectiveness of the system was technically impossible for various reasons.

11789 **(NP—4770088) Utilizing solar energy in greenhouses.** Damrath, J. (Hannover Univ. (Germany, F.R.). Inst. fuer Technik in Gartenbau und Landwirtschaft). Dec 1982. 212p. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE84770088.

The investigation refers to the utilization of the collecting characteristics of greenhouses and the utilization of solar energy in heating greenhouses. The basic points of designing a type of a solar system are worked out. The problem is solved by means of a calculation model which presents the energy flows at the greenhouse important for the solar energy utilization and the co-efficiency of the greenhouse with a solar system by means of differential equations. Unknown equations for use in the calculation method are gained from measurements carried out in a test system and the exactness of the calculation in the relevant operational states of the greenhouse was reviewed. Using 20-years' climate data with hourly solution, results on the following points were obtained: 1) quantitative determination of the energy which can be grained from a double-roof glass house; 2) finding criteria for the modules of a type of solar system; 3) investigating the effects of typical green house characteristics on the utilization of solar energy; 4) investigating the effects of the solar energy utilization on the internal climate of greenhouses.

11790 **(PB—83-256388) Proposed solar water heating system for Bradford College. Research report.** Shepherd, W.; Munroe, M.M. (Bradford Univ. (UK). Postgraduate School of Electrical and Electronic Engineering). Nov 1979. 32p. NTIS, PC E04/MF E04.

The climate in Britain is only suitable for low temperature applications of solar energy, e.g. preheating of hot water, due to the characteristics of the sunlight failing on this country and the large seasonal variation in the energy received from the sun. The proposed system uses flat-plate solar collectors to convert incident solar radiation into thermal energy, water being used for energy transfer and storage medium in a preheating tank. A simulation model was set up to analyse the performance of the system under prevailing meteorological conditions. An economic analysis of the system was also given, with details of the relevant computer program. It was concluded that a properly installed and maintained system would save money and energy, providing up to 20% of the annual hot water requirements of the college, supplying water preheated to about 25C.

11791 **Daylighting aspects of the DOE passive commercial buildings program.** Gordon, H.T.; Kurkowski, T.L. (Rittelmann Associates, Washington, DC). *Energy Technology (Washington, D.C.);* **10**: 667-674(Jun 1983). (CONF-830213—).

From 10. energy technology conference; Washington, DC, USA (28 Feb 1983).

DOE has conducted a program to assess passive solar heating in non-residential buildings. Data regarding the daylighting aspects of ten projects is presented in this paper. All ten buildings use daylighting--by various strategies such as lightshelves, clerestory, roof monitor, or skylight--as a primary element in their design. A "percent aperture", the ratio of the glazed solar aperture area to the building floor area, is arrived at, to allow for comparison of projects. It is found that a decrease in the amount of auxiliary lighting requirements occurs with an increase in percent aperture. Also, the amount of total auxiliary energy decreases with increase in percent aperture. After one year performance evaluation the projects are expected to utilize approximately 50% less energy than conventional designs.

11792 **Establishing wind data for passive systems design.** Robbins, C.L.; Hunter, K.C.; Smith, N. (Solar Energy Research Inst., Golden, CO). pp 273-274 of 5th Miami international conference on alternative energy sources. Vezirogla, T.N. (ed.). Coral Gables, FL; Univ. of Miami (1983). (CONF-821213—).

From 5. international conference on alternative energy source; Miami Beach, FL, USA (13 Dec 1982).

11793 **Heat transfer from immersed coils.** Feiereisen, T.J.; Beckman, W.A.; Duffie, J.A.; Klein, S.A. (Solar Energy Laboratory, University of Wisconsin-Madison, Madison, WI). *American Society of Mechanical Engineers, [Paper];* 82-WA/SOL-18: 6(1982). (CONF-821101—).

From ASME winter annual meeting (Engineering applications of laser velocimetry/published in ASME Jr. Fluid Engineering); Phoenix, AZ, USA (14 Nov 1982).

Solar water heating systems often use immersed coils (internal heat exchangers) located at or near the bottom of a thermal storage tank. Four types of coil configurations were experimentally studied and the results are presented in the form of Nusselt number as a function of Rayleigh number along with coil parameters such as effectiveness and overall-loss coefficient-area product, (UA). Methods for analysis of immersed coils are presented and some schemes to enhance the performance of immersed coils are explored and discussed.

11794 **Solar regeneration of lithium chloride solutions in open cycle absorption cooling.** Lof, O.G.; Lenz, T.G.; Rao, S. (Colorado State University, Fort Collins, Colorado). *American Society of Mechanical Engineers, [Paper];* 82-WA/SOL-6: 6(1982). (CONF-821101—).

From ASME winter annual meeting (Engineering applications of laser velocimetry/published in ASME Jr. Fluid Engineering); Phoenix, AZ, USA (14 Nov 1982).

Reconcentration of a lithium chloride solution in an open cycle absorption chiller can be accomplished by passing solar heated air through a packed column to which the dilute solution is supplied. Following a theoretical study of heat transfer and water vapor transfer rates in the column, experimental measurement of those rates was made. Heat transfer and mass transfer coefficients are correlated with rates of air and liquid flow, and with temperatures of air and liquid supply. Performance data are presented and commercial design and operating requirements are suggested.

11795 **Solar-powered/fuel-assisted Rankine cycle power and cooling system: simulation method and seasonal performance.** Lior, N.; Koai, K. (Department of Mechanical Engineering and Applied Mechanics, University of Pennsylvania, Philadelphia, PA). *American Society of Mechanical Engineers, [Paper];* 82-WA/SOL-8: 8(1982). (CONF-821101—).

From ASME winter annual meeting (Engineering applications of laser velocimetry/published in ASME Jr. Fluid Engineering); Phoenix, AZ, USA (14 Nov 1982).

The subject of this analysis is a solar cooling system based on a novel hybrid steam Rankine cycle. Steam is generated by the use of solar energy collected at about 100° C, and it is then superheated to about 600° C in a fossil-fuel fired superheater. The addition of about 20-26% of fuel doubles the power cycle's efficiency as compared to organic Rankine cycles operating at similar collector temperatures. A comprehensive computer program was developed to analyze the operation and performance of the entire power/cooling system. Transient simulation was performed on an hourly basis over a cooling season in two representative climatic regions (Washington, DC, and Phoenix, AZ). One of the conclusions is that the seasonal system COP is 0.82 for the design configuration, and that the use of watercooled condensers and flat-plate collectors of higher efficiency increases this value to 1.35.

11796 **Solar-powered/fuel-assisted Rankine cycle power and cooling system: sensitivity analysis.** Lior, N.; Koai, K. (Department of Mechanical Engineering and Applied Mechanics, University of Pennsylvania, Philadelphia, PA). *American Society of Mechanical Engineers, [Paper];* 82-WA/SOL-7: 8(1982). (CONF-821101—).

From ASME winter annual meeting (Engineering applications of laser velocimetry/published in ASME Jr. Fluid Engineering); Phoenix, AZ, USA (14 Nov 1982).

The subject of this analysis is a solar power/ cooling system based on a novel hybrid steam Rankine cycle. Steam is generated by the use of solar energy collected at about 100° C, and it is then superheated to about 600° C in a fossil-fuel fired superheater. The addition of about 20-26% of energy as fuel doubles the power cycle's efficiency as compared to organic Rankine cycles operating at similar collector temperatures. A sensitivity analysis of the system's performance to the size and type of its components was performed by a transient (hourly) computer simulation over the month of August in two representative climatic regions (Washington, DC, and Phoenix, AZ), and led to the description of a system configuration which provides optimal energy performance. The newly-designed turbine's predicted efficiency is seen to be essentially invariant with system configuration, and has a monthly average value of about 73%.

11797 **Simulation analysis of Trombe wall system performance based on the Akbari-Borgers channel flow solution.** Tichy, J.; Quinn, C. (Rensselaer Polytechnic Institute, Troy, NY). *American Society of Mechanical Engineers, [Paper];* 82-WA/SOL-11: 8(1982). (CONF-821101—). Contract W-7405-ENG-48.

From ASME winter annual meeting (Engineering applications of laser velocimetry/published in ASME Jr. Fluid Engineering); Phoenix, AZ, USA (14 Nov 1982).

A computer simulation analysis has been performed for the Trombe wall passive solar energy system with a thermosyphoning air channel. The present paper differs from earlier studies in that the primary focus is on natural convection aspects of the problem in the air flow channel rather than thermal storage and conduction in the wall. The air flow is described by the AkbariBorgers correlations which are based on numerical solution of the continuity, momentum and energy equations for the case of laminar flow at low Grashof numbers and on turbulence modeling at high Grashof numbers. Optics, insolation and heat conduction are handled by BLAST, a detailed public domain building analysis program. Several important issues relating particularly to commercial buildings are studied here for the first time: the effect of wall height and the effect of a low-mass insulated wall. The most interesting result is that an insulated massless wall is superior to concrete walls over the heating season in terms of efficiency, heat delivered and air flow delivered. This conclusion holds true regardless of climate. In fact, the more severe the climate, the more decisive the superiority. The physical reason is that energy is quickly delivered to the interior, rather than stored in the wall where it is susceptible to being lost to the environment.

11798 **Large climate-moderating envelopes for enclosed structures - a preliminary evaluation of energy conservation potential.** Giles, G.E.; Park, J.E.; Wenot, R.L. (Union Carbide Corporation, Nuclear Division, Oak Ridge, Tennessee). *American Society of Mechanical Engineers, [Paper];* 82-WA/SOL-12: 8(1982). (CONF-821101—).

From ASME winter annual meeting (Engineering applications of laser velocimetry/published in ASME Jr. Fluid Engineering); Phoenix, AZ, USA (14 Nov 1982).

One method of reducing the energy consumption of one or more buildings is to isolate the buildings within a large envelope. The envelope moderates the effects of sun, wind and precipitation and provides a more benign climate for habitation, commerce and, in some climates, agricultural activities. In this paper, results of a preliminary study of the qualitative energy conservation benefits are given for a large climate-moderating envelope (LCME). The study included the effects of weather, fluid circulation and radiant transport within the envelope and energy storage in the earth mass beneath the LCME. Based on model studies for selected days, the annual energy savings for summer-dominated climates was estimated to be about 70%. The energy savings for a winter-dominated climate LCME were estimated to be somewhat smaller, about 40%.

1410 Solar Collectors And Concentrators

REFER ALSO TO CITATION(S) 11743, 11746, 11747

11799 **(BMFT-FB-T—83-202) Flat plate heat pipe collectors made by rollbonding.** Tanner, W.; Molt, W.; Flesch, T. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Oct 1983. 106p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84750520.

The heatpipe technology was adapted to the method of rollbonding metals which is specially suited for mass production. Those plane heatpipes were investigated for solar collector applica-

tion. The thermodynamic of rollbonded plates with an integrated heat exchanger and heatpipe was examined for different geometrical configurations. Prototypes were laboratory checked and modified. Material strength and increasing heatpipe pressure are giving problems at higher temperature as 130-200°C. Those problems could be solved. Anyhow, with all necessary precaution the application of a roll-bonded plane heatpipe in a solar collector is not economical in a present situation.

11800 **(CONF-831252—1) Solar pond performance estimation, engineering design, and construction experience.** Hull, J.R. (Argonne National Lab., IL (USA)). 11 Dec 1983. Contract W-31-109-ENG-38. 15p. NTIS, PC A02/MF A01. Order Number DE84003992.

From Royal Scientific Society conference; Amman, Jordan (9 Dec 1983).

A solar pond is a low-cost solar collector and storage device for low-temperature (less than 110°C) heat. However, there are many design and construction details that must be considered to obtain the optimum efficiencies necessary to achieve economical performance. Several of these considerations, as well as a brief description of mathematical models for estimating performance, are discussed in this paper.

11801 **(DOE/CS/33977—T2) Solar pond studies: I, II, III. Final report.** Bryant, H.C. (New Mexico Univ., Albuquerque (USA). Dept. of Physics and Astronomy). 25 Aug 1983. Contract AS04-77CS33977. 8p. NTIS, PC A02/MF A01. Order Number DE84003946.

A brief history of the solar pond work is presented. A temperature of 109°C was reached. The effects of boiling on solar ponds were studied. Experience with a KNO_3 pond is mentioned briefly. (MHR)

11802 **(SERI/PR—255-2168) Active solar heating and cooling program. Polymer stabilization film-forming, high-temperature polymers. Annual progress report, FY 1983.** Schissel, P.; Neidlinger, H.H. (Solar Energy Research Inst., Golden, CO (USA)). Dec 1983. Contract AC02-83CH10093. 25p. NTIS, PC A02/MF A01. Order Number DE84000093.

Assessment of the performance of polymeric films at elevated temperatures under solar exposure conditions is made difficult because little comparative test data exists. Answers are needed to the following questions: 1) what are the changes in physical properties over a wide temperature range, i.e., what is the physical temperature stability and what is the effect of long-term exposure to high temperature, ultraviolet (UV) light, and different environmental conditions; i.e., what is the chemical temperature stability. The present report summarizes literature data for some higher temperature polymers. Film brittleness and other mechanical factors are considered but are not necessarily reasons for rejection in this initial sorting process. Materials that form films are listed in two categories. When data indicate that transparent films can be made, this is emphasized in the first category even though the films may be colored. Data are rarely available on the transmittance of experimental films. If the films are not transparent or if data are lacking, the films are listed in the second category. The data are listed for experimental films and for films more recently commercialized that appear to merit special consideration.

11803 **(SERI/TR—253-1662) Low-temperature IPH parabolic troughs: design variations and cost-reduction potential.** Gee, R.C. (Solar Energy Research Inst., Golden, CO (USA)). Nov 1983. Contract AC02-83CH10093. 37p. NTIS, PC A03/MF A01. Order Number DE84000024.

Parabolic trough concentrating collectors have improved in performance and reliability since the US Department of Energy's solar thermal program began. The development of components has been tailored to meeting instantaneous collector performance goals at an operating temperature of 315°C (600°F). Although this strategy has resulted in advanced component designs and excellent collector performance at 315°C, it has also necessitated somewhat stringent, expensive component design requirements. Near-term parabolic trough collector systems are too expensive to compete widely with conventional fossil-fuel systems. This report describes how collector costs can be reduced with lower-temperature designs. Industrial process heating energy use at below 150°C (300°F) is over five times greater than that at from 200° to 315°C (400°F to 600°F). Component designs for lower temperatures are considered, including less rigid, lighter-weight concentrators; alternative concentrator constructions; larger receivers; and multiple-row drive systems.

1420 Heat Storage

11804 **(PNL—4970) Thermochemical seasonal energy storage for solar thermal power.** Barnhart, J.S. (Pacific Northwest Lab., Richland, WA (USA)). Jan 1984. Contract AC06-76RL01830. 23p. NTIS, PC A02/MF A01. Order Number DE84006108.

During the many years that thermochemical energy storage has been under investigation, the concept has been plagued with two persistent problems: high capital cost and poor efficiency. Literally hundreds of chemical reactions have also been carried out. For short-term storage, thermochemical systems suffer in comparison with highly efficient sensible storage media such as molten salts. Long-term storage, on the other hand, is not cost-competitive with systems employing fossil backup power. Thermochemical storage will play a significant role in solar thermal electric conversion only under highly select circumstances. The portion of electric demand served by solar plants must be sufficiently high that the balance of the grid cannot fully supplant seasonal storage. High fossil fuel costs must preclude the use of gas turbines for backup power. Significant breakthroughs in the development of one or more chemical reaction systems must occur. Ingeniously integrated systems must be employed to enhance the efficiency and cost-effectiveness of thermochemical storage. A promising integration scheme discussed herein consists of using sensible storage for diurnal cycling in parallel with thermochemical seasonal storage. Under the most favorable circumstances, thermochemical storage can be expected to play a small but perhaps vital role in supplying baseload energy from solar thermal electric conversion plants.

11805 **(SERI/STR—230-2065) Direct-contact high-temperature thermal energy storage heat exchanger. Final subcontract report.** Alario, J.; Brown, R. (Grumman Aerospace Corp., Bethpage, NY (USA)). Sep 1983. Contract AC02-83CH10093. 88p. NTIS, PC A05/MF A01. Order Number DE84000012.

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A 10-kWh scale model high-temperature direct-contact latent-heat-exchange thermal energy storage system was designed and fabricated. A research program was structured in three separate phases to permit: Phase I - the inspection and evaluation of the origin al hardware, which suffered extensive corrosion and damage in a previous experimental program; Phase II - redesign and fabrication of a modified system; and Phase III - detailed test evaluation. On the basis of the findings in Phase I, the design was modified to eliminate previous deficiencies. A test plan was also prepared that contained detailed information concerning instrumentation (type and location), measured parameters, and equipment operating procedures. Phase II entailed component procurement and fabrication, system assembly, and instrumentation. At the end of Phase II, the system was in a ready-for-test condition but the program was terminated before the start of the Phase III test evaluation. Since testing was never implemented, this report presents only the results for the design and fabrication phases of the program.

11806 **Photochemical storage potential of azobenzenes.** Olmsted, J.; Lawrence, J.; Yee, G.G. (Department of Chemistry, California State University/Fullerton, Fullerton, CA 92634). *Solar Energy;* **30**: No. 3, 271-274(Mar 1983). Contract FG02-79ER10546.

The potential for storage of solar energy using photochemical trans-cis, isomerizations of substituted azobenzenes has been studied. Polar substituents are found to red-shift the π-π^* absorption spectrum of these compounds without destroying the endothermicity of the photoisomerization. Highly red-shifted compounds such as azonaphthalenes revert thermally to the trans isomer within seconds. Methyl orange has the most favorable energy storage potential of the compounds studied and has a storage efficiency of 16

per cent for 436 nm irradiation and 2 per cent for AM-1 isolation. Because of limited solubilities and rapid thermal reversion rates in polar solvents, it is concluded that azobenzenes are not favorable compounds for photochemical solar energy storage.

11807 **Effect of melting point in the performance of phase change thermal storage.** Ftenakis, V.M. (Brookhaven National Lab., Upton, NY). pp 477-479 of 5th Miami international conference on alternative energy sources. Vezirogla, T.N. (ed.). Coral Gables, FL; Univ. of Miami (1983). (CONF-821213—).

From 5. international conference on alternative energy source; Miami Beach, FL, USA (13 Dec 1982).

11808 **Reactor design for a chemical heat pump.** Evans, D.R. (EG and G Idaho, Inc., Idaho Falls); Larson, T.K.; Chipman, N.A.; Fitch, C.N.; Jolly, D.A.; Krupa, J.F. pp 591-592 of 5th Miami international conference on alternative energy sources. Vezirogla, T.N. (ed.). Coral Gables, FL; Univ. of Miami (1983). (CONF-821213—).

From 5. international conference on alternative energy source; Miami Beach, FL, USA (13 Dec 1982).

15 GEOTHERMAL ENERGY

1501 Resource Status And Assessment

REFER ALSO TO CITATION(S) 12145

11809 **(PB—83-252684) Faisabilte technique et economique de la geothermie basse energie en Europe(Technical and economic feasibility of low-energy geothermal sources in Europe). Final report.** (Commission of the European Communities, Luxembourg). [nd]. 294p. (EUR—8241/1-FR). NTIS, PC E12/MF E12.

Important potential geothermal resources exist in the EEC; while only Italy possesses assured high-energy sources, almost all of the other countries possess potential low-energy sources which are worth evaluating. An attempt is made to demonstrate in general the technical and economic feasibility of exploiting these resources within the range of 30 C and 150 C.

1502 Geology And Hydrology Of Geothermal Systems

11810 **(EGG-M—23883) Fundamental approach to the simulatoin of flow and dispersion in fractured media.** Miller, J.D. (EG and G Idaho, Inc., Idaho Falls (USA)). 1983. Contract AC07-76ID01570. 8p. (CONF-831253—4). NTIS, PC A02/MF A01. Order Number DE84005453.

From 9. workshop on geothermal reservoir engineering; Stanford, CA, USA (13 Dec 1983).

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Global flow and dispersion in an aquifer occur in the interconnected fractures and may be related to specific fracture elements. A fluid dynamics code named SALE has been used to solve the Navier-Stokes equations for laminar flow in these elemental geometries. A marker particle calculation has been added to characterize longitudinal dispersion due to the velocity profile across the fracture and lateral dispersion due to flow disturbances at junctions. Local flow and dispersion in the matrix occur in the finer fracture structure and are evaluated using porous media approaches. These results or models are integrated in a 2D isothermal reservoir simulator named FRACSL. Discrete fractures are superimposed on the edges or diagonals of rectangular grid elements. Water may flow from node to node through the matrix or through the fracture. The heads are found by iterating for the distribution which conserves the appropriate local mass. Marker particles are used to monitor the tracer dispersion due to motion in the fractures, in the matrix and between the two. Results are given showing flow and dispersion in an orthogonal junction and in a sample fractured reservoir.

11811 **(USGS-PP—1044-I) Geothermal hydrology of Warner Valley, Oregon: a reconnaissance study.** Sammel, E.A.; Craig, R.W. (Geological Survey, Reston, VA (USA)). 1981. 67p. GPO.

Warner Valley and its southern extension, Coleman Valley, are two of several high-desert valleys in the Basin and Range province of south-central Oregon that contain thermal waters. At least 20 thermal springs, defined as having temperatures of 20°C or more, issue from Tertiary basaltic flows and tuffs in and near the valleys. Many shallow wells also produce thermal waters. The highest measured temperature is 127°C, reported from a well known as Crump geyser, at a depth of 200 meters. The hottest spring, located near Crump geyser, has a surface temperature of 78°C. The occurrence of these thermal waters is closely related to faults and fault intersections in the graben and horst structure of the valleys. Chemical analyses show that the thermal waters are of two types: sodium chloride and sodium bicarbonate waters. The warmer waters are likely to have higher concentrations of sodium and chloride, as well as sulfate, silica, and dissolved solids, than the cooler waters. Chemical indicators show that the geothermal system is a hot-water rather than a vapor-dominated system. Conductive heat flow in areas of the valley unaffected by hydrothermal convection is probably about 75 milliwatts per square meter. The normal thermal gradient in valley-fill deposits in these areas may be about 40°C per kilometer. Extensive areas underlain by thermal ground water occur near Crump geyser and Fisher Hot Spring.

1503 Geothermal Exploration And Exploration Technology

REFER ALSO TO CITATION(S) 11811

11812 **Development of improved high temperature seals and lubricants for downhole motors in geothermal applications.** De La Fosse, P.H.; Black, A.D.; DiBona, B.G.; Sandstrom, J.L.; Tibbitts, G.A. (Drilling Research Laboratory, Salt Lake City, UT). *American Society of Mechanical Engineers, [Paper];* **83-PET-23**: 9(1983).

A major limitation of downhole mud motors for geothermal drilling, as well as straight-hole oil and gas drilling, is the bearing section. Reduced bearing life results from the inability to seal a lubricant in the bearing pack. A reliable rotary seal will extend the bearing life and will allow high pressure drops across the bit for improved bottomhole cleaning and increased drilling rate. This paper summarizes the results of a six-year program funded by the U.S. Department of Energy/Division of Geothermal Energy to develop a sealed bearing pack for use with downhole motors in geothermal applications. Descriptions of the Seal Test Machine, Lubricant Test Machine and Bearing Pack Test Facility are presented. Summaries of all seal tests, lubricant tests and bearing pack tests are provided; and a comprehensive program bibliography is presented.

1504 Legal And Institutional Aspects

11813 **Site-specific nature of geothermal energy: the primary role of land-use planning in nonelectric development.** Pasqualetti, M.J. (Arizona State Univ., Tempe). *Natural Resources Journal;* **23**: No. 4, 795-814(Oct 1983).

Communities considering the use of geothermal resources for nonelectrical purposes must recognize its close link to land use and the important role of advance community planning. An examination of sites in several western states underscores the need for compatible land use if geothermal development is to be economical. It is important to avoid retrofitting costs that could result if the community waits until the resource is proven before making land use plans. 43 references, 1 figure, 4 tables. (DCK)

1505 Economic And Financial Aspects

11814 **A comparison of economic evaluation models as applied to geothermal energy technology.** Ziman, G.M.; Rosenberg, L.S. (Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Drive, Pasadena, CA). *Energy (Oxford);* **8**: No. 10, 797-811(Oct 1983).

Several cost estimation and financial cash flow models have been applied to a series of geothermal case studies. In order to draw conclusions about relative performance and applicability of

these models to geothermal projects, the consistency of results was assessed. The model outputs of principal interest in this study were net present value, internal rate of return, or levelized breakeven price. The models used were VENVAL, a DuPont, Inc. venture analysis model; the Geothermal Probabilistic Cost Model (GPC Model) and the Alternative Power Systems Economic Analysis Model (APSEAM), which were developed at the Jet Propulsion Laboratory (JPL); the MITRE Corporation's Geothermal Loan Guarantee Cash Flow Model (GCFM); and the GEOCOST and GEOCITY geothermal models developed by Battelle Pacific Northwest Laboratories. The case studies to which the models were applied include a geothermal reservoir at Heber, CA; a geothermal electric power plant to be located at the Heber site; an alcohol fuels production facility to be built at Raft River, ID; and a direct-use, district heating system in Susanville, CA.

1506 Environmental Aspects And Waste Disposal

REFER ALSO TO CITATION(S) 12274

1508 Geothermal Power Plants

REFER ALSO TO CITATION(S) 11814

11815 **(DOE/SF/11700—T1) Final phase testing and evaluation of the 500 kW direct contact pilot plant at East Mesa.** Olander, R.; Oshmyansky, S.; Nichols, K.; Werner, D. (Barber-Nichols Engineering Co., Arvada, CO (USA)). Dec 1983. Contract AC03-83SF11700. 166p. NTIS, PC A08/MF A01. Order Number DE84004781.

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The testing performed during the last phase of the geothermal direct contact heat exchanger program utilizing the 500 kW pilot plant provided more insight into the capabilities and limits of the direct contact approach and showed that more work needs to be done to understand the inner workings of a large direct contact heat exchanger if they are to be modeled analytically. Testing of the column demonstrated that the performance was excellent and that the sizing criteria is conservative. The system operated smoothly and was readily controlled over a wide range of operating conditions. Performance evaluation showed pinch differentials of 4°F or less and better than predicted heat transfer capability. Testing during this final phase was directed towards establishing the limits of the column to transfer heat. The working column height was shortened progressively to approximately 16 feet from a design length of 28 feet. The short column performed as well as a full length column and there are indications that the column could have been shortened even more without affecting its ability to transfer heat. The column's ability to perform as well with shortened lengths indicates that the heat transfer coefficients and criteria derived from the small scale tests are very conservative.

11816 **A calcium carbonate scale inhibitor for direct-contact binary geothermal service.** Auerbach, M.H.; Olander, R.G.; Rapier, P.M.; Reimer, R.A. (Pfizer Central Research). *Journal of Petroleum Technology;* **35**: No. 9, 1546-1552(Aug 1983).

A 500-kW direct-contact binary-cycle pilot geothermal power plant was constructed and successfully operated free of scale at the U.S. DOE East Mesa geothermal test facility. The pilot plant used an Elgin tower direct contact heat exchanger (DCHX) with isobutane as the working fluid. Initial tests with the untreated 340°F (170°C) geothermal brine gave heavy calcium carbonate fouling of the brine boost pump, flow monitors, and flow-control valves within 20 to 50 hours of startup. Use of 2 ppm high-temperature polymeric scale inhibitor in the feed brine enabled plant operation for more than 700 hours without formation of detrimental scale. The antiscalant was not extracted into the working fluid and did not emulsify the hydrocarbon/brine interface. On the basis of dosage and flow, the additive cost was calculated to be about 0.06 per net kW-hr of power generated.

1509 Geothermal Engineering

REFER ALSO TO CITATION(S) 11812, 11816

11817 **(PB—84-113547) Corrosion of selected metals and a high-temperature thermoplastic in hypersaline geothermal brine. Report of investigations/1983.** Conrad, R.K.; Carter, J.P.; Cramer, S.D. (Bureau of Mines, Avondale, MD (USA). Avondale Research Center). Sep 1983. 25p. (BM-RI—8792). NTIS, PC A02/MF A01.

The Bureau of Mines conducted corrosion research to determine suitable construction materials for geothermal resource recovery plants. Weight loss, pitting and crevice corrosion, U-bend stress corrosion, and electrochemical polarization measurements were made on selected metals in brine and steam process environments produced from high-enthalpy hypersaline brine from geothermal well Magmamax No. 1 at the Salton Sea Known Geothermal Resources Area, Imperial Valley, Calif.

11818 **(SAND—83-2416C) Mapping the acid stimulation in the Beowawe geothermal field using surface electrical potentials.** Hart, C.M.; Engi, D.; Morris, H.E. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 6p. NTIS, PC A02/MF A01. Order Number DE84004995.

A surface electrical potential system was fielded during the chemical stimulation of the Rossi 21-19 well in the Beowawe Geothermal Field. The technique, which measures variations in resistivity resulting from the flow of conductive fluid into the reservoir, was not only shown to be highly sensitive to the chemical treatment, but was also responsive to in situ conductive zones before any acid injection. A review of the experiment and a preliminary interpretation of the data are presented. The data provide convincing evidence that it should be possible to map the treated zone as well as the primary pretreatment in situ conductive zones.

11819 **Vapor-pressure lowering in geothermal systems.** Hsieh, C.H.; Ramey, H.J. Jr. (Conoco Inc.). *Society of Petroleum Engineers of A.I.M.E. (American Institute of Mining, Metallurgical and Petroleum Engineers), Paper;* **23**: No. 1, 157-167(Feb 1983).

The water vapor-pressure lowering phenomenon in porous media was investigated for a range of temperatures by measuring vapor pressure vs. mass of water adsorbed in consolidated sandstone cores and unconsolidated silica sands. Experimental results showed that the mass of water adsorbed on the rock surface is much more than the amount of pore steam. Results also revealed that the water adsorption is caused mainly by micropores in the porous medium. Measurement of the mass of methane and ethane adsorbed on dry rocks showed that the amount of adsorption is not great in comparison with the pore gas. It was found that adsorption data for water/sandstone core studies could be normalized with respect to temperature. Although this appears not to have been reported previously, it does agree in principle with findings for solid powders with micropores. Another interesting result was that reanalysis of previous studies of capillarity in sandstones indicates that experimental data probably were influenced mostly by adsorption.

11820 **Drainage of aqueous foams: Generation-pressure and cell-size effects.** Rand, P.B.; Kraynik, A.M. (Sandia Natl. Laboratories). *Society of Petroleum Engineers of A.I.M.E. (American Institute of Mining, Metallurgical and Petroleum Engineers), Paper;* **23**: No. 1, 152-154(Feb 1983). Contract AC04-76DP00789.

The physical characteristics of aqueous foams make them excellent candidates for drilling fluids in geothermal formations. A major concern in this application is the foam-forming ability of a surfactant system in the harsh geothermal environment. While investigating the stability of various foams in an autoclave, we observed a dramatic increase in drainage times with increasing generation pressure, even though the liquid volume fraction of the foam was held constant. This effect appears to result from a decrease in cell size with increasing autoclave pressure and therefore is an artifact of the foam generation technique in which the pressure path of the foam changes with autoclave pressure. A theoreti-

cal model of drainage predicts that drainage times should increase with decreasing cell size, as observed. These results emphasize that proper control of cell size can have a substantial effect on the apparent stability of a foam.

1510 Direct Energy Utilization

REFER ALSO TO CITATION(S) 12289

11821 (PB—83-255703) Geothermal district heating system feasibility analysis, Thermopolis, Wyoming. Final report 1981-82. Goering, S.W.; Garing, K.L.; Coury, G.; Mickley, M.C. (Thermopolis, City of, WY (USA); Coury and Associates, Lakewood, CO (USA)). 26 Apr 1982. 92p. NTIS, PC A05/MF A01.

Thermopolis-1980 population 3,852-explored the heat demand and potential for the use of geothermal water from springs in and adjoining the town. The study included consideration of the legal implications of tapping the springs and the possibility of depletion of the resource, which is the focal point of a state park. The study also considered the mechanical problem of the distribution system, the design of which is complicated by the chemical composition of the thermal water. The study concluded that a district heating system was not yet feasible, but could be within five years depending on natural gas prices.

11822 (PB—83-255968) Union County, La Grande, Oregon, geothermal district heating: feasibility study. Final report 1981-82. Jenkins, H. II; Giddings, M.; Hanson, P. (Union County Planning Dept., La Grande, OR (USA)). Sep 1982. 103p. NTIS, PC A06/MF A01.

La Grande is the county seat, with a 1980 population of 11,372 is the largest city in Union County. It is located in an area of known geothermal water. Temperatures range from 70 deg. F. to as high as 185 deg. F. Unfortunately, the high temperature wells are located eight and one half miles distant from the city. Areas with concentrated high heat loads were identified in the business district, and nearby institutions consisting of Eastern Oregon State College, a high school, a hospital, and several public buildings. Costs of installing and operating a district heating system were calculated as if it were to be an investor owned utility. Rates to customers would be 30% below the current costs of fuels now being used. The first three years would involve an operating loss, after that the system would pay debt service and operate at a profit. The feasibility of the DHC system depends almost entirely upon bringing in one or more warm water wells within or close to the city limits, with temperatures not less than 150 deg. F, a minimum of 15,000 gpm and at depths not more than 2,500 feet. The return water will be reinjected and it will be reheated by the same natural forces.

16 TIDAL AND WAVE POWER

1607 Tidal Power Plants

11823 Confined radial buoyant jet. Fry, D.J.; Adams, E. (David Taylor Naval Ship Research and Development Center, Bethesda, MD). *Journal of Fusion Energy;* **109**: No. 9, 1185-1202(Sep 1983).

A submerged, negatively buoyant radial jet, discharging horizontally beneath a free surface into water of initially uniform density, was studied experimentally and theoretically. The situation relates to the operation of an ocean thermal energy conversion plant and is an example of buoyancy and confinement offering opposing influences on jet trajectory. For shallow submergence, the jet is attached to the free surface while for large submergence or greater (negative) buoyancy, the jet is detached. An experimental program yielded data on jet trajectory, temperature, velocity and discharge conditions associated with transition between attached and detached regimes. A hysteresis effect was noted as the conditions for attachment and detachment were different. Dimensional analysis yielded a single parameter of primary importance and two parameters of secondary importance in describing jet behavior. An integral jet analysis based on a spreading assumption was successfully adapted to include induced velocity and pressure effects on jet behavior.

1608 Wave Energy Converters

REFER ALSO TO CITATION(S) 11780

17 WIND ENERGY

1701 Availability (climatology)

11824 (PNL—4889) Weather pattern climatology of the United States. Barchet, W.R.; Davis, W.E. (Pacific Northwest Lab., Richland, WA (USA)). Jan 1984. Contract AC06-76RL01830. 164p. NTIS, PC A08/MF A01. Order Number DE84005883.

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In this study the geographic domain covered the 48 conterminous states of the United States. The daily synoptic weather pattern was classified into nine types for the 10-year period January 1, 1969 to December 31, 1978. Weather pattern types were defined relative to the classical polar front model of a mid-latitude cyclonic storm system and its associated air masses. Guidelines for classifying weather patterns on an operational basis were developed. These were applied to 3652 daily surface weather maps to produce a time series of weather pattern type at 120 grid points of a 160 point, 3° latitude by 4° longitude array over the United States. Statistics on the frequency of occurrence, persistence and alternation of weather patterns were calculated for each grid point. Summary statistics for the entire grid and for six regions were also presented. Frequency of occurrence and persistence were found to depend on the size and speed of movement of the weather pattern. Large, slow moving air masses had higher frequency of occurrence and longer persistence than small (fronts) or rapidly moving (or changing) features (fronts, storm centers). Some types showed distinct regional preferences. The subtropical maritime high occurred mainly in the south central and southeast. An indeterminate weather pattern type accounted for those weather patterns that did not fit the polar front model or were too disorganized to be classified. The intermountain thermal low of the desert southwest was one such feature that dominated both frequency of occurrence and persistence in this region. Alternation from one weather pattern to another followed the polar front model of a moving cyclonic storm. The tendency for anticyclonic weather patterns to become disorganized as they weakened was seen in the high percentage of these patterns that changed to an indeterminate pattern as they aged.

1706 Wind Energy Engineering

REFER ALSO TO CITATION(S) 12536

11825 (AD-A—132117/3) Princeton windmill program. Sweeney, T.E. (Princeton Univ., NJ (USA). Dept. of Aerospace and Mechanical Sciences). Mar 1973. 31p. NTIS, PC A03/MF A01.

The Flight Concepts Laboratory of Princeton University became interested in windmills as a direct consequency of the research performed over the years with the Princeton Sailwing. This device, first conceived as an advanced sail for a boat and later applied to a wing for aircraft use has attracted the attention of many able undergraduate and graduate students who have been largely responsible for its present rather refined status. The Sailwing is explained in more detail in the following section. It is, briefly a physically simple structure of light weight for its load carrying capability and has the aerodynamic characteristics of well designed rigid wings in the low speed range - up to approximately 150 knots. Above that speed there appears to be no reason why its interesting characteristics should not be maintained; however, its weight advantage might, depending upon design requirements, be somewhat reduced. Because the Sailwing is simple and lightweight; it is, therefore, inexpensive in comparison to more conventional wings. This economic advantage is compounded when one considers the

greatly reduced dynamic effects of a light weight rotor on the ruggedness of the supporting structure of a windmill.

11826 **(CONF-840112—2) Method for determining how to operate and control wind turbine arrays in utility systems.** Javid, S.H.; Hauth, R.L.; Younkins, T.D.; Roddoch, T.W.; Barnes, P.R. (General Electric Co., Schenectady, NY (USA). Electric Utility Systems Engineering Dept.; Oak Ridge National Lab., TN (USA)). Jan 1984. Contract W-7405-ENG-26. 8p. NTIS, PC A02/MF A01. Order Number DE84005817.

From IEEE Power Engineering Society winter meeting; Dallas, TX, USA (29 Jan 1984).

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A method for determining how utility wind turbine arrays should be controlled and operated on the load frequency control time-scale is presented. Initial considerations for setting wind turbine control requirements are followed by a description of open loop operation and of closed loop and feed forward wind turbine array control concepts. The impact of variations in array output on meeting minimum criteria are developed. The method for determining the required control functions is then presented and results are tabulated. (LEW)

11827 **(DOE/CS/89002—T1) Performance and flow analysis of vortex wind power turbines.** Rangwalla, A.A.; Hsu, C.T. (Iowa State Univ. of Science and Technology, Ames (USA). Engineering Research Inst.). Oct 1982. Contract FG02-80CS89002. 94p. NTIS, PC A05/MF A01. Order Number DE84005708.

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The theoretical study presented investigates some possible vortex flow solutions in the tornado-type wind energy system and evaluates the power coefficient that can be obtained theoretically. The actuator disc concept is applied to the vortex wind turbine configuration. The Burgers vortex model is then introduced and the performance of a turbine using it is derived. A generalized analytical solution of the model is given, followed by a numerical solution of the complete equations. The stability of a Burgers vortex is discussed. (LEW)

11828 **(DOE/R4/10163—T1) Five power generating windmills. Final report.** DeBever, O.J. (DeBever (Omer J.), Bay Saint Louis, MS (USA)). [nd]. Contract FG44-80R410163. 2p. NTIS, PC A02/MF A01. Order Number DE84000329.

Five electric power generating windmills are being installed on two 80 ft. self supporting steel towers and three atop 90 ft. guyed steel towers. The generators are rated 1800 watts at a wind velocity of 24 mph and have a maximum capability of 2100 watts at 28 mph. The prime power is a 3-bladed prop having a peripheral diameter of 13 ft. The windmill will start turning when the wind velocity reaches 9 mph at which speed it will generate about 200 watts. Power increases approximately 130 watts with each 2 mph increase in wind velocity.

11829 **(ECN—83-140) Investigation on the conversion system of the 25 m horizontal axis wind turbine (HAT) at Petten.** Jacobs, J.L. (Stichting Energieonderzoek Centrum Nederland, Petten). Jun 1983. 174p. (In Dutch). ECN, P.O. Box 1, 1755 ZG Petten, Netherlands.

A description is given of the 25 m HAT. Particular attention is paid to the conversion system, control, measurement and recording. The dynamic behavior of the rotating parts of the conversion system is investigated during operation and during the applications of brakes. An attempt is made to bring the results into a calculation model; this attempt was only partly successful. Not enough data could be collected to give full explanation of the entire behavior of the system. Total efficiency and the conversion efficiency were measured. Power curves were made at three rotation speeds (n = 40; n = 50 and n = 70).

11830 **(ECN—83-167) Aerodynamic performance of the two bladed, 25 m diameter HAWT calculated by program PERF.** Tanoemihardja, S. (Stichting Energieonderzoek Centrum Nederland, Petten). Mar 1983. 23p. ECN, P.O. Box 1, 1755 ZG Petten, Netherlands.

Aerodynamic calculations are presented on the two bladed, 25 m diameter horizontal axis wind turbine (HAWT) of NACA 23018 profile using the program PERF. Comparisons with other calculations and the measurement results are presented.

11831 **(ECN—83-169) Aerodynamic performance of the horizontal axis wind turbine of NACA 4415 using partially linearized aerodynamic data and the program PERF. (A comparative study).** Tanoemihardja, S. (Stichting Energieonderzoek Centrum Nederland, Petten). Oct 1983. 50p. ECN, P.O. Box 1, 1755 ZG Petten, Netherlands.

A program, named PERF, has been developed to calculate the performance of the horizontal axis wind turbine. Simpson's rule is applied to perform the numerical integration. A NACA 4415 profile with the Reynold Number of 3.3 x 10/sup 5/ has been studied using different blade configurations. The aerodynamic data is approximated by linear interpolations. The calculation results are analyzed and presented.

11832 **(ISU-ERI-AMES—83073) Effect of radial inflow on vortex intensification for a tornado-type wind turbine.** Hsu, C.T.; Ide, H. (Iowa State Univ. of Science and Technology, Ames (USA). Engineering Research Inst.). Sep 1982. Contract FG02-80CS89002. 114p. NTIS, PC A06/MF A01. Order Number DE84005243.

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A new wind vortex turbine, called tornado-type wind turbine, was studied both theoretically and experimentally for the purpose of better understanding the basic nature of a vortex flow and further improvement of its power efficiencies. Analytical solutions were obtained from the Navier-Stokes equations for the velocity distributions along the radial distance. The result demonstrates the important nature of a vortex structure that, in order to intensify a vortex inside the tower, radial inflow must be provided from the side walls. Based upon this concept, the essential contribution of our experimental work was to furnish the radial inflow by utilizing the dynamic head of incoming wind.

11833 **Measured effect of wind generation on the fuel consumption of an isolated diesel power system.** Stiller, P.; Scott, G.; Shaltens, R. (Advanced Systems Tech., Westinghouse Electric Corp., Pittsburgh, PA). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Power Apparatus and Systems;* **102**: No. 6, 1788-1792(Jun 1983).

The Block Island Power Company (BIPCO), on Block Island, Rhode Island, operates an isolated electric power system consisting of diesel generation and an experimental wind turbine. The 150-kW wind turbine, designated MOD-OA by the U.S. Department of Energy is typically operated in parallel with two diesel generators to serve an average winter load of 350 kW. Wind generation serves up to 60% of the system demand depending on wind speed and total system load. Results of diesel fuel consumption measurements are given for the diesel units operated in parallel with the wind turbine and again without the wind turbine. The fuel consumption data are used to calculate the amount of fuel displaced by wind energy. Results indicate that the wind turbine displaced 25,700 lbs. of the diesel fuel during the test period, representing a calculated reduction in fuel consumption of 6.7% while generating 11% of the total electrical energy. The amount of displaced fuel depends on operating conditions and system load. It is also shown that diesel engine throttle activity resulting from wind gusts which rapidly change the wind turbine output do not significantly influence fuel consumption.

11834 **Methods of reducing wind power changes from large turbine arrays.** Schlueter, R.; Dorsey, J.; Lotfalian, M.; Park, G.; Shayanfar, M. (Michigan State Univ., E. Lansing, MI). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Power Apparatus and Systems;* **102**: No. 6, 1642-1650(Jun 1983).

This paper discusses methods of reducing the WECS generation change through selection of the wind turbine model for each site, selection of an appropriate siting configuration, and wind array controls. An analysis of wind generation change from an echelon and a farm for passage of a thunderstorm is presented to establish

the factors concerning the wind turbine model and siting configuration that contribute to these variations. Detailed simulation results indicate more precisely how these factors can be exploited to minimize the WECS generation changes observed. Reduction of the wind generation change over ten minutes is shown to reduce the increase in spinning reserve, unloadable generation and load following requirements on unit commitment when significant WECS generation is present and the farm penetration constraint is satisfied. Controls on the blade pitch angle of all wind turbines in an array or a battery control are shown to reduce both the wind generation change out of an array and the effective farm penetration in anticipation of a storm so that the farm penetration constraint may be satisfied.

11835 **Some aspects of fluctuating vertical wind shears.** Doran, J.C. (Pacific Northwest Laboratory, Richland, WA 99352). *Solar Energy;* 30: No. 5, 473-480(May 1983). Contract AC06-76RL01830.

Fluctuating vertical shears of wind speed have been measured using anemometers on an array of towers. The statistical distributions of these shears are compared with formulas proposed by Fichtl and good agreement is found. A comparison of Fichtl's formula for $\sigma\Delta u$, the standard deviation of the fluctuating shears, with a more empirical one proposed by Ramsdell shows that the latter is consistent with the former under the proper conditions. The probability of occurrence of extreme shears in speed is discussed. Fluctuating shears two or more times larger than the mean values are shown to occur frequently, and their likelihood increases as the mean measuring height increases if Δz is held fixed. These results are applicable for slightly unstable to neutral conditions over level, homogeneous terrain, and in the surface boundary layers. The normal distribution gives a useful lower bound on shear values. Probabilities of extreme shears as a function of $\Delta z/z$ are given, $\sigma\Delta u$ is also shown to be affected by /tau/, the averaging time used for the shear measurements. Increasing /tau/ from 0.2 to 4 sec can decrease $\sigma\Delta u$ by 25 per cent or more. The effects of /tau/ on the probability of extreme events is shown.

11836 **Wind turbine spoiler.** Sullivan, W.N. US Patent Application 6-469,348. [nd]. 16p. Contract AC04-76DP00789.

An aerodynamic spoiler system for a vertical axis wind turbine includes spoilers on the blades initially stored near the rotor axis to minimize drag. A solenoid latch adjacent the central support tower releases the spoilers and centrifugal force causes the spoilers to move up the turbine blades away from the rotor axis, thereby producing a braking effect and actual slowing of the associated wind turbine, if desired. The spoiler system can also be used as an infinitely variable power control by regulated movement of the spoilers on the blades over the range between the undeployed and fully deployed positions. This is done by the use of a suitable powered reel and cable located at the rotor tower to move the spoilers.

11837 **Improved diffuser for augmenting a wind turbine.** Foreman, K.M.; Gilbert, B.L. US Patent Application 6-471,567. [nd]. 10p. Contract AC02-76ET20232.

A diffuser for augmenting a wind turbine having means for energizing the boundary layer at several locations along the diffuser walls is improved by the addition of a short collar extending radially outward from the outlet of the diffuser.

20 ELECTRIC POWER ENGINEERING

REFER ALSO TO CITATION(S) 12190

11838 **(DOE/CE/30685—2) New approaches for the analysis and control of multiterminal ac-dc networks. Final report.** Carroll, D.P.; Ong, C.M. (Purdue Univ., Lafayette, IN (USA). School of Electrical Engineering). Feb 1982. Contract AS01-78CE30685. 75p. NTIS MF A01. Order Number DE84005505.

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Main objective was to explore techniques and develop analytical tools for utilizing the inherent controllability of multiterminal hvdc transmission to enhance the performance of an integrated ac/dc power system. The final report consists of eight major sections. The first four sections pertain to steady-state operation of ac/dc systems, the last four sections are concerned with multiterminal power modulation. Section I presents a novel technique for solving the general load-flow problem for a multiterminal dc network in an integrated ac/dc system. Section II describes a new simplified dc load-flow algorithm for analysis of integrated ac/dc systems. In Section III an algorithm is developed to optimize the steady-state operation of a series-connected multiterminal hvdc system relative to real power losses. Section IV describes a method for coordinating the power transfers of a multiterminal dc system to control line flows in an ac network. Sections V and VI explore the advantages of centralized coordination of multiterminal power modulation. The study reported in Section VII applies a new decentralized eigenvalue assignment technique to the multiterminal hvdc modulation problem. The investigation described in Section VIII evaluates the effectiveness of two different forms of modulation for series-connected multiterminal hvdc systems: (1) a totally decentralized (uncoordinated) voltage modulation scheme, and (2) a centrally coordinated modulation technique using a supervisory program similar to that developed in Section V for the parallel system. A computer simulation of a four-terminal, three-machine power system was used to compare the performance of the two control techniques.

11839 **(DOE/ET/29361—1) Research and development of a methodology for dynamic security assessment for electric energy systems. Final report, September 1979-December 1982.** Baillieul, J. (Scientific Systems, Inc., Cambridge, MA (USA)). Feb 1983. Contract AC01-79ET29361. 104p. NTIS, PC A02. Order Number DE84005459.

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This report presents new results in the theory of stochastic systems and discusses their application to problems of power system dynamic security assessment. Recent results on approximate methods for estimation and filtering of nonlinear stochastic systems are presented. These include Carleman linearization techniques for stochastic systems, Galerkin type approximations, and finite state approximations for continuous processes. Robust estimation techniques based on least absolute values (as opposed to least squares) are also considered. Mathematical models of contingencies relating to system instabilities are treated using techniques from bifurcation and singularity theory. Problems of security assessment for power systems are then formulated in terms of exit time probabilities, and computational methods for determining these are discussed.

11840 **(DOE/NBM—4005279) Northeast power failure, November 9-10, 1965.** (Federal Power Commission, Washington, DC (USA)). 6 Dec 1965. 100p. NTIS MF A01 - GPO $1.00. Order Number DE84005279.

Microfiche only, copy does not permit paper copy reproduction; Report to The President by the Federal Power Commission.

This report is divided into the following chapters: story of blackout; protecting against the likelihood of a recurrence; problems of restoring service; impact of power failure on the people; further studies; and recommendations. (DLC)

11841 **(PB—83-262451) Load flow studies using Newton Raphson decouled method exploiting sparsity. Technical report.** (Central Power Research Inst., Bangalore (India)). Oct 1980. 22p. NTIS, PC E03/MF E03.

The rapid growth of power systems to meet the ever increasing demand for energy has cast a great challenge upon the power system engineer. It devolves on the engineer to technically and economically analyse the various plans before him and assess their relative merits in order to ensure reliable and economical operations of power systems. This, in turn, calls for rigorous and accurate modelling of power systems and their analysis. As a first step, load flow studies form a vital part of system planning and operational studies. There is always a need to improve the technique of analysing the load flow problem and for its accurate and quick analysis. A computer program was developed in CPRI using Newton Raphson decoupled approach which may be of use to various electricity boards.

2001 Power Plants And Power Generation

REFER ALSO TO CITATION(S) 11477, 12124, 12269, 12277, 12277, 12492, 12493

11842 (ILR-MITT—111) Motion stability of turborotors on elastic foundations. Bosin, D. (Technische Univ. Berlin (Germany, F.R.). Inst. fuer Luft- und Raumfahrt). 1982. 146p. (In German). Fachinformationszentrum Energie, Physik, Mathematik, Karlsruhe (Germany, F.R.).

"Stability of Turborotors on Elastic Foundation" the stability of large rotor-bearing-systems has been studied taking into account the influence of an elastic and damped foundation. The report described for that purpose the methods used and first numerical results. A theoretical approach was developed which started with a finite element model of the complete system. Then the large number of unknowns of the substructures was reduced with the aid of a model condensation procedure (component mode method) and the stability-limit was iterated by eigenvalue computation. This limiting rotational speed and the unstable eigenfrequency was calculated on the one hand for a system of 18 degrees of freedom (rotor-bearing-model) and on the other hand for a system of 56 degrees of freedom (rotor-bearing-foundation-model). The influence of rotor stiffness, oil-film stiffness, oil-film damping, Sommerfelds number, foundation stiffness, foundation damping was studied by parameter variation. It turned out, that a realistic stability analysis has to be calculated with the coupled rotor-bearing-foundation-model. In our future work these calculations will be continued and alternative procedures for the eigenvalue computation will be analysed and applied.

11843 (NP—4770073) Model power plant Voelklingen. (Saarbergwerke A.G., Saarbruecken (Germany, F.R.). Hauptabteilung Forschung und Entwicklung, Umweltschutz; Saarbergwerke A.G., Saarbruecken (Germany, F.R.). Produktbereich Kraftwerke). Jul 1983. 12p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84770073.

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In the Model Power Plant Voelklingen a power plant concept by which high-ash coal is burnt in an atmospheric fluidized bed furnace and the combustion is heat abducted by a pipe system immersed into the fluidized bed is applied. The advantages of the process are the excellent heat conduction in the fluidized bed, the low combustion temperature and the possibility to fix the sulfur oxides to the lime or dolomite added to the fluidized bed. An improvement of the power plant efficiency is achieved by the combination of a hot air gas turbine with a common steam turbine process. The entire exhaust gases are treated in an exhaust gas desulfurization plant placed in the interior of the cooling tower.

11844 (NP—4770154) Experimental and theoretical investigation of two-phase flow cooled turbine blades. Siegemund, H.P. (Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Maschinenwesen). 4 Dec 1981. 214p. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE84770154.

The unit power and the internal efficiency of an airplane gas turbine or a stationary gas turbine are the greater the higher the inlet temperature of the turbine and the lower the cooling losses. By means of experimental and theoretical investigations at cooled fixed blades this paper aims at obtaining basic information about the effectivity of two-phase cooling, the achievable heat transfer coefficients and the thermodynamic and flow behavior of such a gas/droplet flow. The setup of the hot gas grid test stand for experimental investigation of the two-phase, two-component air/droplet flow is described as well as the experiments carried out and their results. Among other things a water-cooled infrared light conducting probe for measuring blade surface temperatures is presented, which will be used for parts of the blade surface that are difficult to access for miniature sheathed thermocouples. It is shown by theoretical calculation of the temperature field in the blade by means of the finite-element method how the internal heat transfer coefficients can be calculated from the boundary conditions measured in the experiments. A mathematical method is presented allowing to calculate and analyze a one-dimensional gas/droplet flow with two-phase friction, heat supply and variation of the cross-section.

11845 Database methods in power system control centres. Lehman, R.; Mattioni, J. (Marco Corp., Fort Washington, PA). *International Journal of Electrical Power and Energy Systems;* 5: No. 4, 241-246(Oct 1983). Contract AC01-79ET29364;AC01-82CE76221.

Historically, the electric power industry has used computer systems in energy control centres to monitor and control power system devices. Little heed was paid to the efficient management of the databases for evolving applications such as system security studies, extensive data storage and retrieval, and reporting functions. As these applications have grown in importance, however, vendors have developed and supplied ad hoc software for managing the databases, thereby increasing their practical usefulness. Current practices in database management are summarized and proposed approaches now in their early development stages are considered.

11846 Increasing power plant efficiency with an ammonia bottoming cycle. Hauser, S.G.; Johnson, B.M. (Pacific Northwest Laboratory, Richland, Washington). *Proceedings, Intersociety Energy Conversion Engineering Conference;* 2: 668-677(Aug 1983). (CONF-830812—).

From 18. intersociety energy conversion engineering conference; Orlando, FL, USA (21 Aug 1983).

A Rankine cycle with ammonia as the working fluid was examined for operation between the condenser and cooling tower of a typical steam-cycle power plant. During periods of cold ambient temperature this ammonia bottoming cycle increases the net output of the plant as much as 10% by improving the net thermal efficiency. The levelized cost of this extra power was estimated to be as little as 50 mills/kWh in colder climates. This paper highlights a study conducted at the Pacific Northwest Laboratory to assess the technical and economic feasibility of using these ammonia bottoming cycles in air-cooled power plants. The thermodynamic and heat transfer properties of ammonia make it the best choice to serve the dual purpose of a heat transfer medium and a thermodynamic working fluid. Several operational modes are discussed, including the possibility of replacing the entire low-pressure steam turbine with an ammonia turbine. Costs, however, are estimated only for the case of a typical steam-cycle power plant with steam condensing at 120°F or less.

11847 A parametric study of MHD/Steam combined cycle thermal performance. Lundberg, W.L. (Westinghouse Advanced Energy Systems Division, Pittsburgh, Pennsylvania). *Proceedings, Intersociety Energy Conversion Engineering Conference;* 5: 2260-2265(Aug 1983). (CONF-830812—).

From 18. intersociety energy conversion engineering conference; Orlando, FL, USA (21 Aug 1983).

An analysis is described which predicts the thermal performance of an MHD/Steam combined cycle power plant. The work was done parametrically to show performance sensitivities and to identify peak performance values of key topping cycle variables. For this purpose, a steady-state system model was used that integrates in a single, quick-running calculation, the topping and bottoming cycles as well as auxiliary systems such as the air separation unit and the seed regeneration plant. Total system models are very effective in work of this kind because plant response to variations in virtually any parameter can be analyzed and peak performance points are readily identified.

11848 Residential air-to-air heat exchangers: performance, energy savings, and economics. Fisk, W.J.; Turiel, I. (Lawrence Berkeley Laboratory, Energy and Environment Division, University of California, Berkeley, CA). *Energy and Buildings;* 5: No. 3, 197-211(Jun 1983).

This paper discusses the performance of residential heat exchangers and summarizes results from tests of several models. It also compares the energy consumed, during the heating season, in low-infiltration houses with heat exchangers, with the energy consumed in typical houses in four cities throughout the United States. For each city, a cost-benefit analysis is performed from the point of view of a home-owner. Houses with natural gas, oil, and electrical

heating systems are considered. The analysis indicates that the energy required to heat ventilation air in homes employing heat exchangers is 5.3 - 18.0 GJ less than the energy required to heat ventilation air in typical homes. In homes with heat exchangers, the heat exchanger's fan system required 2.2 3.6 GJ of electrical energy during the heating season. The net present benefit for homes employing heat exchangers, when compared with typical homes, ranged from -$1350 to +$2400 and discounted payback periods ranged from five to over 30 years. The cost-effectiveness of employing heat exchangers was found to be highly affected by climate, type of heating fuel, heat exchanger performance, and ventilation rate.

11849 **Effect of size and location of conventional and intermittent generation on system reliability.** Yamayee, Z.A.; Ma, F.S. (Pacific Northwest Utilities Conf., Committee, Portland, OR). *International Journal of Electrical Power and Energy Systems;* 5: No. 2, 94-100(Apr 1983).

A method of assessing the cost-effectiveness of different generating technologies is presented, which helps the planner decide, for a given generating system and in a given year, which technology is the most effective in improving the reliability of the generating system. The method also allows the planner to rank technologies according to their cost-effectiveness. Also presented is a procedure for assessing the relative merits of centralized and decentralized generating technology. A case study is described that illustrates how the method works.

11850 **Alternate energy conversion systems.** Larson, J.W. (Riley Stoker Corp., Worcester, MA). *American Society of Mechanical Engineers, [Paper];* 83-PET-1: 8(1983).

The variety of advanced coal-burning power plant concepts currently under consideration for utility electric generation are described. These concepts include fluidized beds and combined cycles evolved from conventional steam and gas turbine systems now used in utility service. Performance comparisons are presented between the advanced concepts and an advanced steam plant. Application of these advanced concepts to repowering of existing plants is discussed.

11851 **Water-cooled gas turbine nozzle technology demonstration at ultra-high firing temperature.** Geilling, D.W.; Klompas, N.; Zeman, K.P. (Gas Turbine Division, General Electric Company, Schenectady, New York). *American Society of Mechanical Engineers, [Paper];* 83-GT-15: 9(1983). (CONF-830309—).

From 28. ASME international gas turbine conference; Phoenix, AZ, USA (27 Mar 1983).

During Phase II of the Department of Energy (DOE) funded High Temperature Turbine Technology (HTTT Program, critical technology development and component verification testing related to the design of an advanced watercooled gas turbine, firing at 2600°F (1427°C) on low-Btu gas, are being performed by General Electric. A composite construction first stage nozzle was chosen so that low surface temperature (1000°F (538°C)), necessary to control corrosion and high heat flux induced strain, would result. This paper discusses the prototype testing of a three throat segment of this design. The segment consists of two test vanes and a pressure and suction side slave. Hot gas conditions exceeded the design point conditions of 2600°F (1427°C) firing temperature, 166 psia (1.14 MPa) and 6.37 lbm/s (2.89 kg/s) per throat. Nozzle temperatures are presented as a function of firing temperature. Discussion of boiling phenomena which occurred during coolant flow reduction is included Results are discussed as they relate to verification of the design method and to establishing the "technology readiness" of this design.

11852 **Metering cooling flows in the water-cooled gas turbine.** Grondahl, C.M. (Gas Turbine Division, General Electric Company, Schenectady, New York). *American Society of Mechanical Engineers, [Paper];* 83-GT-38: 7(1983). (CONF-830309—).

From 28. ASME international gas turbine conference; Phoenix, AZ, USA (27 Mar 1983).

Metering of coolant flow to bucket cooling passages in the water-cooled gas turbine rotor was experimentally evaluated. Through water flow per cooling passage is approximately one gallon per hour and rotor "g" field is approximately 20,000 g's, the water-cooled gas turbine depends on uniform water distribution. Measurements indicative of water distribution accuracy to eight buckets and representative cooling passages in each bucket were made in separate tests. Rotor water pressure measurements were made at both metering elements and compared to static differential pressure data. This work is part of the technology development and component verification testing of an advanced water-cooled gas turbine, firing at 2600°F (1427°C) being performed by General Electric under Phase II of the U.S. Department of Energy (DOE) funded High Temperature Turbine Technology (HTTT) Program.

11853 **Development of the transpiration air-cooled turbine for high temperature dirty gas streams.** Wolf, J.; Moskowitz, S. (Curtiss-Wright Corp., Wood-Ridge, NJ). *American Society of Mechanical Engineers, [Paper];* 83-GT-84: 5(1983). (CONF-830309—). Contract AC01-76ET10348.

From 28. ASME international gas turbine conference; Phoenix, AZ, USA (27 Mar 1983).

Studies of combined cycle electric power plants have shown that increasing the firing temperature and pressure ratio of the gas turbine can substantially improve the specific power output of the gas turbine as well as the combined cycle plant efficiency. Furthermore, tomorrow's gas turbines must do more than operate at higher temperature; they will likely face an aggressive hot gas stream created by the combustion of heavier oils or coal-derived liquid or gaseous fuels. Extensive tests have been performed on two rotating turbine rigs, each with a transpiration air cooled turbine operating in the 2600 to 3000°F (1427 to 1649°C) temperature range at increasing levels of gas stream particulates and alkali metal salts to simulate operation on coal-derived fuel. Transpiration air cooling was shown to be effective in maintaining acceptable metal temperatures, and there was no evidence of corrosion, erosion, or deposition. The rate of transpiration skin cooling flow capacity exhibited a minor loss in the initial exposure to the particulate laden gas stream of less than 100 hours, but the flow reduction was commensurate with that produced by normal oxidation of the skin material at the operating temperatures of 1350°F (732°C). The data on skin permeability loss from both cascade and engine tests compared favorably with laboratory furnace oxidation skin specimens. To date, over 10,000 hr of furnace exposure has been conducted. Extrapolation of the data to 50,000 hr indicates the flow capacity loss would produce an acceptable 50°F (10°C) increase in skin operating temperature.

11854 **Performance potential of an advanced nuclear gas turbine/cogeneration system (HTGR-GT/C).** McDonald, C.F.; Kapich, D.; Vanhagan, T.H. (GA Technologies, Inc., San Diego, CA). *American Society of Mechanical Engineers, [Paper];* 83-GT-101: 11(1983). (CONF-830309—). Contract AT03-76SF70046.

From 28. ASME international gas turbine conference; Phoenix, AZ, USA (27 Mar 1983).

The success of the closed-cycle gas turbine depends on utilizing high-grade waste heat. This paper presents features for an advanced nuclear gas turbine operating with a reactor outlet temperature of 950°C. It discusses the results of a systems study exploring the performance potential of an advanced nuclear gas turbine/cogeneration concept (HTGR-GT/C) with a high-temperature gas-cooled reactor heat source. It also highlights the flexibility of operation with regard to combined electrical power generation and process steam production.

11855 **Coal as an option for power generation in U.S. territories of the Pacific.** Borg, I.Y. (Lawrence Livermore National Laboratory, Livermore, CA). *Energy (Oxford);* 7: No. 11, 875-895(Nov 1982).

General considerations relating to the use of coal in U.S. territories and trust territories of the Pacific suggest that coal is a viable option for power generation. Future coal supplies, principally from Australia and the west coast of America, promise to be more than adequate. Except for Guam, with peak power requirements on the order of 175 MW /SUB e/ , most territories have current, albeit inadequate, installations of 1-25 MW /SUB e/ . Turnkey, conventional-coal-fired, electrical-power generating sys-

tems are available in that size range. Fluidized bed combustion is another option currently being commercialized. Its use has clear environmental advantages and a variety of fuels (e.g. coal, heavy oils, biomass, etc.) may be employed without interruption of power generation. U.S. environmental laws, such as the Clean Air Act, are now applicable to Guam and American Samoa; the trust territories are exempt. The principal problems with coal use in the territories, apart from the shallow draft of most harbors, are the limited amount of land available and the high capital costs associated with conversion. Ocean dumping of ash and sludge can be permitted under existing Environmental Protection Agency regulations, and barge-mounted power installations are not out of the question. The feasibility of converting from oil-fired to coal-fired electrical-power generating systems must be determined with site-specific information.

2002 Environmental Aspects

REFER ALSO TO CITATION(S) 11422, 11446, 11479, 12723

11856 (GSF-A—3/83, pp 91-103) **Desulfurization of flue gas from large furnaces.** Killinger, E. Apr 1983. (In German). Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). (CONF-830159—).

From Seminar of Gesellschaft fuer Strahlen- und Umweltforschung on SO/sub 2/ and the consequences; Munich, F.R. Germany (20 Jan 1983).

The $CaCO_3$-gypsum procedure, now commonly used, is briefly explained in the paper and the Babcock plant for flue gas desulfurization and gypsum deposit at the 700-MW Mehrum power plant described.

2003 Power Transmission And Distribution

REFER ALSO TO CITATION(S) 11849, 12273, 12867

11857 (AD-A—131730/4) **Shock and vibration digest. Volume 15, Number 6.** Nagle-Eshleman, J. (Naval Research Lab., Washington, DC (USA). Shock and Vibration Information Center). Jun 1983. 102p. Availability: SVIC, Naval Research Lab., Code 5804, Washington, DC 20375 HC $140.00 Annually (No copies furnished by DTIC/NTIS).

Partial Contents: Nonlinear Vibrations of Plates--a Review; Literature Review--Mechanical signature analysis, and Static and dynamic behavior of mechanical components assoicated with electrical transmission lines; and Abstracts from the Current Literature.

11858 (NP—4770080) **Data validation by network search techniques for power system monitoring and control.** Bonanomi, P. (Eidgenoessische Technische Hochschule, Zurich (Switzerland)). 1982. 116p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE84770080.

A real-time data base for power system monitoring and control must provide an accurate and reliable representation of the system state, based on the available measurements, indications and network parameters. The well-established method for achieving this goal is static state estimation, which calculates a best of the measurements onto the mathematical model. Based on these results, bad data can be detected and identified by analysing the residuals between the measurements and the calculated quantities. A new approach is proposed in this work, wherein data validation is performed by a sequential search through the network graph. It is shown that data validation can be achieved without the usual data fitting. The numerical results are not exactly identical with the corresponding state estimation results, but they lie within a certain statistical bandwidth of the true load flow values. The new technique consists of performing a set of consistency checks using appropriate tolerance margins, and grading the involved network elements in a systematic way. Bad data are identified at the end of the calculation process by sorting the suspicious elements according to the grading results.

11859 (PB—83-262303) **Study of overhead lines in marine environments. Technical report.** (Central Power Research Inst., Bangalore (India)). Sep 1980. 10p. NTIS, PC E03/MF E03.

An attempt is made in the report to assess the effect of wind on transmission lines in addition to the problem due to corrosion. Broadly discussed, are the complexities arising out of such a situation and remedial measures under such circumstances. The report also gives the data obtained as a result of survey conducted on a country-wide basis.

11860 (PB—83-263319) **Studies on insulator pollution under industrially contaminated conditions. Technical report.** (Central Power Research Inst., Bangalore (India)). Mar 1978. 21p. NTIS, PC E03/MF E03.

The studies reveal the hazards to which insulators situated in industrial areas are subject to. Industrial contaminants are agricultural fertilizers, cement, fly ash, coal dust, oxides and sulphates of various metals etc. The silicone grease has been proved to be equally effective in combating industrial pollution. It is hoped that, in the context of increased industrialisation, the studies brought forth in this report will be helpful in laying down guidelines for design of transmission lines passing through industrial belts.

11861 **Distribution energy control center experiment.** McConnell, B.; Monteen, L.; Purucker, S.; Reddoch, T. (Energy Division, Oak Ridge National Lab, Oak Ridge, TN). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Power Apparatus and Systems;* **102**: No. 6, 1582-1589(Jun 1983). Contract W-7405-ENG-26.

The ultimate goal of integrating the generic functions presently described as supervisory control and data acquisition, load management, and distribution feeder automation into a single system has led to the proposed concept of a distribution energy control center (DECC). An experiment is being conducted on the Athens Utilities Board's (AUB) distribution network in the Tennessee Valley Authority (TVA) service area. When successfully implemented, the installed hardware/software could become a test bed for future end use and distribution automation experiments. The DECC system will feature distribution automation and control concepts, develop closed loop control of feeder and substation functions, and extend and examine various load management concepts. DECC will be linked to TVA's bulk power control system.

11862 **A reevaluation of the normal operating state control (AGC) of the power system using computer control and system theory; Part III: tracking the dispatch targets with unit control.** Kambale, P.; Mukai, H.; Spare, J.; Zaborszky. (Dept. of Systems, Science and Math, Washington Univ., St. Louis, MO). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Power Apparatus and Systems;* **102**: No. 6, 1903-1912(Jun 1983). Contract AC01-78ET29636;AC01-79ET29367.

The Automatic Generation Control (AGC) of the power system is examined in this paper from the vantage point of digital computer oriented estimation-optimization-control technology, and a new scheme is proposed which exploits solution techniques and experiences of the past and of the current practice. Economic Dispatch and Load Frequency Control are unified in this approach. This paper deals with the problem of tracking the economic target curves. In tracking the target curves, unit dynamics, including boiler dynamics, are taken into account. The problem is decomposed in such a way that the slower, bulk control is based on a fully nonlinear and dynamic model of the unit while faster load fluctuations are traced by fast, dynamic vernier control based on a linearized model. This results in fuel economy coupled with tight and smooth control which demands very moderate computational load. Constraints on turbine power and on its rate of change are considered explicitly as well as reduced economy at valve points. Cogeneration and load management are readily introduced into this scheme.

11863 Super conducting fault current limiter and inductor design. Rogers, J.; Boenig, H.; Chowdhuri, P.; Schermer, R.; Weldon, D.; Wollan, J. (Los Alamos Nat.'l Lab., Los Alamos, NM 87545). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **19**: No. 3, 1054-1058(May 1983).

A superconducting fault current limiter (SFCL) that uses a biased superconducting inductor in a diode or thyristor bridge circuit was analyzed for transmission systems in 69, 138, and 230 rms kV utility transmission systems. The limiter was evaluated for costs with all components--superconducting coil, diode and/or SCR power electronics, high voltage insulation, high voltage bushings and vapor cooled leads, dewar, and refrigerator--included. A design was undertaken for the superconducting cable and coils for both diode and SCR 69 kV limiter circuits.

11864 Superconducting magnetic energy storage for BPA transmission line stabilization. Rogers, J.; Barron, M.; Boenig, H.; Criscuolo, A.; Dean, J.; Schermer, R. (Los Alamos Nat.'l Lab, Los Alamos, NM 87545). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **19**: No. 3, 1078-1080(May 1983).

The Bonneville Power Administration (BPA) operates the electrical transmission system that joins the Pacific Northwest with southern California. A 30 MJ (8.4 kWh) Superconducting Magnetic Energy Storage (SMES) unit with a 10 MW converter is being installed at the Tacoma Substation to provide system damping for low frequency oscillations of 0.35 Hz. The integrated system status is described and reviewed. Components included in the system are the superconducting coil, seismically mounted in an epoxy fiberglass nonconducting dewar; a helium refrigerator; a heat rejection subsystem; a high pressure gas recovery subsystem; a liquid nitrogen trailer; the converter with power transformers and switchgear; and a computer system for remote microwave link operation of the SMES unit.

11865 Full-power trials of the Brookhaven superconducting power transmission system. Forsyth, E; Morgan, G. (Brookhaven Nat'l Lab. Associated Universities Inc., Upton, NY 11973). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **19**: No. 3, 652-655(May 1983).

The power transmission test facility at Brookhaven consists of a 700 W supercritical helium cooling system, cable enclosure about 100 m long, four cable terminations, electrical excitation equipment and control and monitoring instrumentation. The cryogenic system was tested extensively prior to installation of two cables in late 1981. Each cable is terminated at each end so that full-power electrical trials are possible with the simultaneous application of voltage and current. The operating characteristics with the cable carrying 4,100 A (60 Hz) at 80 kV to ground are presented; this corresponds to a rated power of 330 MVA per cable. The full engineering evaluation of the system is estimated to take about 30 weeks of running, it is unlikely to be completed in 1983.

21 NUCLEAR POWER PLANTS

11866 (INIS-mf—8208) Peaceful uses of nuclear power in the USSR. Fantschenko, S.D. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). (Deutsches Atomforum e.V., Bonn (Germany, F.R.)). 1982. 15p. (In German). (CONF-8210184—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704243.

From Meeting on peaceful uses of nuclear power in the USSR; Bonn, F.R. Germany (14 Oct 1982).

Part of this presentation is a report on the situation of nuclear power plants in the USSR, on nuclear district heating, the nuclear vehicle drive, the future development of breeder reactors and controlled fusion, as well as on safety and environmental problems. (UA).

11867 (INIS-mf—8558) Chemical regimes in thermal and nuclear power plants. (Ceskoslovenska Vedeckotechnicka Spolecnost, Usti nad Labem. Dum Techniky). 1981. vp. (In German). (CONF-8109240—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84780059.

From 7. national conference on power plant chemistry; Usti nad Labem, Czechoslovakia (8 Sep 1981).

Separate abstracts are presented for each of the papers included in the data base.

11868 (INIS-mf—8578) Thirtieth annual report 1981-82. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Jan 1983. 129p. NTIS (US Sales Only), PC A07/MF A01. Order Number DE83704244.

Changes in the AAEC research program arising from the revised Government energy research arrangements announced in April 1981 are outlined. Projects in fission reactor technology, the nuclear fuel cycle, fusion, environmental studies, radiation technology, the application of radioisotopes and radiopharmaceutical research are discussed. Details of the production, sales and distribution of medical radioisotopes, of the Regulatory Bureau and of international relations are also included.

11869 (NUREG—0020-Vol.7-No.9) Licensed operating reactors status summary report, August, 1983. Vol. 7, No. 9. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Resource Management). Nov 1983. 442p. NTIS, PC A19/MF A01 - GPO. Order Number DE84900693.

This document provides data on the operation of nuclear units as timely and accurately as possible. This information is collected to the Office of Resource Management from the Headquarters staff of NRC's Office of Inspection and Enforcement, from NRC's Regional Offices, and from utilities. The three sections of the report are: monthly highlights and statistics for commercial operating units, and errata from previously reported data; a compilation of detailed information on each unit, provided by NRC's Regional Offices, IE Headquarters and the utilities; and an appendix for miscellaneous information such as spent fuel storage capability, reactor-years of experience and non-power reactors in the US.

11870 (NUREG—0020-Vol.7-No.11) Licensed operating reactors. Status summary report, data as of October 31, 1983. Volume 7, No. 11. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Resource Management). Jan 1984. 406p. NTIS, PC A18/MF A01 - GPO. Order Number DE84900514.

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This report provides data on the operation of nuclear units as timely and accurately as possible. Since all of the data concerning operation of the units is provided by the utility operators less than two weeks after the end of the month, necessary corrections to published information are shown on the ERRATA page. This report is divided into three sections: the first contains monthly highlights and statistics for commercial operating units, and errata from previously reported data; the second is a compilation of detailed information on each unit, and the third section is an appendix for miscellaneous information such as spent fuel storage capability, reactor years of experience and non-power reactors in the United States.

2101 Power Reactors, Non-breeding, Light-water

Moderated, Boiling Water Cooled

REFER ALSO TO CITATION(S) 11654, 11944, 11957, 11972, 12026, 12036, 12042, 12054, 12064, 12066, 12073, 12074, 12075, 12078, 12079, 12080, 12081, 12082, 12083, 12084, 12085, 12086, 12087, 12088, 12089, 12090, 12091, 12092, 12093

11871 (DOE/ET/34006—10) Extended burnup demonstration reactor fuel program: poolside fuel examination. Big Rock Point extended burnup fuel, November 1980. Exarhos, C.A. (Consumers Power Co., Jackson, MI (USA); Exxon Nuclear Co., Inc., Richland, WA (USA); GPU Nuclear Corp., Parsippany, NJ (USA)). Dec 1983. Contract AC02-79ET34006. 76p. (XN-NF—81-62). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84006223.

Under the program, standard ENC-fabricated reload fuel in the Big Rock Point and Oyster Creek cores is to be irradiated to discharge burnups in excess of 35,000 MWD/MTU, one to two cycles beyond its originally projected exposure life. The program provides for examination of the fuel at poolside before and after each extended burnup cycle as well as for limited destructive examination in hot cells. This report documents the results of the 1980 fuel examination conducted on the Big Rock Point EBD fuel at EOC 16 November 1980. Measurements of fuel rod diameter and rod length were obtained on 32 rods from one assembly, supplemented by eddy current testing and visual inspection. The rods, at an average exposure of 35,400 MWD/MTU, were found to be in excellent condition and were returned to the assembly for an additional cycle of irradiation.

11872 (DOE/ET/34031—12) BWR fuel bundle extended burnup program. Technical progress report, January 1981-December 1981. Baumgartner, J.A. (comp.). (General Electric Co., San Jose, CA (USA); Northern States Power Co., Minneapolis, MN (USA)). Jul 1983. Contract AC02-80ET34031. 84p. (GEAP—30083). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84004200.

At the start of this reporting period, there were eight fuel bundles operating to extended burnup in the Monticello Nuclear Generating Plant. Four of these bundles were discharged in April 1981 at average burnups which ranged from 34.9 GWd/MTU to 39.6 GWd/MTU. The other four bundles continued in operation and reached burnups of 38.8 to 42.3 GWd/MTU at the end of this reporting period. Results of the examinations and tests on fuel from these bundles are reported. The results indicate excellent performance to the burnups thus far achieved.

11873 (GEAP—30245) Gamma scan measurements at Monticello Nuclear Generating Plant following cycle 9. Shiraishi, L.M.; Fawks, J.E.; Kosanke, H.D.; Rose, P.C.; Laput, H.A. (General Electric Co., San Jose, CA (USA). Nuclear Fuel and Special Projects Div.). Aug 1983. Contract AC02-80ET34031. 115p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE84005882.

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A program to measure the relative La-140 intensity distribution in a sample of irradiated fuel was conducted at the Monticello Nuclear Generating Plant following the cycle 9 shutdown. The measurements consisted of out-of-core underwater scanning of the 1596 keV gamma ray from La-140 with a gamma ray detector and collimating device, and with a data acquisition and analysis system configured around a minicomputer. The procedural details of the measurement program and the results of the scan analyses are documented in this report. The data are presented in several different formats in order to facilitate review and evaluation.

11874 (UCID—19927) Technical evaluation of the electrical, instrumentation, and control design aspects of the proposed license amendment Revision 1 for single-loop operation of the Monticello Nuclear Generating Plant, Unit 1 (Docket No. 50-263). Donich, T.R. (Lawrence Livermore National Lab., CA (USA)). 16 Dec 1983. Contract W-7405-ENG-48. 10p. NTIS, PC A02/MF A01. Order Number DE84004758.

This report documents the technical evaluation of the proposed changes to the plant reactor protection system by the licensee of Monticello Nuclear Generating Plant, Unit 1, to account for single-loop plant operation. This evaluation is restricted to only the electrical, instrumentation and control design aspects of proposed changes to the plant technical specifications for single-loop operation beyond 24 hours. The conclusion of the evaluation is that the license amendment for single-loop operation has met the review criteria provided anomalous control room indications are corrected or warning-tagged for the duration of single-loop operations.

11875 (UCID—19963) Technical evaluation of the electrical, instrumentation, and control design aspects of the proposed license amendment Revision 1 for single-loop operation of Browns Ferry Nuclear Plants (Docket No. 50-259, Unit 1; Docket No. 50-260, Unit 2; Docket No. 50-296, Unit 3). Donich, T.R. (Lawrence Livermore National Lab., CA (USA)). 16 Dec 1983. Contract W-7405-ENG-48. 9p. NTIS, PC A02/MF A01. Order Number DE84004757.

This report documents the technical evaluation of the proposed changes to the plant reactor protection system by the licensee of Browns Ferry Nuclear Power Station, Units 1, 2, and 3, to account for single-loop plant operation. This evaluation is restricted to only the electrical, instrumentation and control design aspects of proposed changes to the plant technical specifications for single-loop operation beyond 24 hours. Conclusion is that the license amendment for single-loop operation has met the review criteria provided sufficient administrative controls are in effect, and any anomalous control room indicators are corrected or warning-tagged for the duration of single-loop operation.

11876 Coolant monitoring apparatus for nuclear reactors. Tokarz, R.D. (to Dept. of Energy). US Patent 4,405,559. 20 Sep 1983. Filed date 6 Aug 1981. vp.

PAT-APPL-290289.

A system is disclosed for monitoring coolant conditions within a pressurized vessel. A length of tubing extends outward from the vessel from an open end containing a first line restriction at the location to be monitored. The flowing fluid is cooled and condensed before passing through a second line restriction. Measurement of pressure drop at the second line restriction gives an indication of fluid condition at the first line restriction. Multiple lengths of tubing with open ends at incremental elevations can measure coolant level within the vessel.

2102 Power Reactors, Non-breeding, Light-water Moderated, Non-boiling Water Cooled

REFER ALSO TO CITATION(S) 11574, 11654, 11876, 12003, 12004, 12005, 12007, 12010, 12012, 12014, 12016, 12017, 12019, 12023, 12027, 12029, 12032, 12033, 12034, 12035, 12036, 12037, 12038, 12039, 12040, 12043, 12044, 12046, 12047, 12048, 12049, 12050, 12053, 12055, 12059, 12065, 12066, 12069, 12072, 12074, 12077, 12958

11877 (CEA-CONF—6854) Inspection of water spaces of PWR fuel assemblies. Merard, R.; Lebreton, S. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Jun 1983. 7p. (In French). (CONF-8306157—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750469.

From Meeting of the European working group on hot laboratories and remote handling; Petten, Netherlands (8 Jun 1983).

A measuring method using a laser has been carried out to inspect the spaces between the fuel elements. The method is described; it has been fitted to operate under irradiation.

11878 (CEGB-P—1) Sizewell 'B' power station public inquiry: CEGB proof of evidence. CEGB policy. Baker, J.W. (Central Electricity Generating Board, London (UK)). Nov 1982. 76p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE83703894.

The case for Sizewell B in terms of the CEGB's overall duties, policies and objectives is presented. The discussion concentrates on the rationale of the CEGB's wish to proceed with Sizewell B and the implications which an eventual decision to proceed with a Gas Cooled Reactor at Sizewell could have for future power station orders.

11879 **(CEGB-P—4) Sizewell 'B' power station public inquiry: CEGB proof of evidence. The need for Sizewell 'B'.** Jenkin, F.P. (Central Electricity Generating Board, London (UK)). Nov 1982. 155p. NTIS (US Sales Only), PC A08/MF A01. Order Number DE83703907.

The CEGB's planning and assessment procedures relating to Sizewell B are explained. The various bases of need for new generating plant capacity are outlined. These are: capacity requirement; provision of economic generating capacity; security of fuel supplies; making provision for future investment options. A detailed case for Sizewell B is then presented, including an assessment of risk and uncertainty.

11880 **(CEGB-P—9) Sizewell 'B' power station public inquiry: CEGB proof of evidence. The nuclear fuel cycle.** Wright, J.K. (Central Electricity Generating Board, London (UK)). Nov 1982. 73p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE83703908.

A general description of the nuclear fuel cycle for PWRs and AGRs is given. The details of the fuel cycle for Sizewell B are explained and its cost is analysed against a specific set of background assumptions. Then, in less detail, an evaluation of PWR fuel cycle costs is presented against a wide range of background assumptions. The cost of the AGR fuel cycle is analysed. Finally the uncertainties in the results obtained are considered.

11881 **(CEGB-P—10) Sizewell 'B' power station public inquiry: CEGB proof of evidence. Design of the Sizewell 'B' PWR.** George, B.V. (Central Electricity Generating Board, London (UK)). Nov 1982. 237p. NTIS (US Sales Only), PC A11/MF A01. Order Number DE83703895.

The design of the proposed Sizewell B power station and the policies which have guided design choices are outlined. The specification for Sizewell B and the production of its reference design are discussed. The Nuclear Steam Supply System and the associated safeguards systems are dealt with in more detail. The protection against hazards causing damage to plant and the protection provided to reduce radiation exposure are described. Control, instrumentation and operation of the plant are discussed. A section on quality of design follows. Finally economic aspects of the design are dealt with.

11882 **(CEGB-P—15) Sizewell 'B' power station public inquiry: CEGB proof of evidence. Steam generator tube integrity.** Newell, J.E. (Central Electricity Generating Board, London (UK)). Nov 1982. 76p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE83703896.

A brief description is given of the design of the steam generators for the proposed Sizewell B power station. A review of the operational behaviour of earlier models is presented. The problem of degradation of steam generator tubes is considered in some detail. Model F steam generator, which has been incorporated into the Sizewell B reference design, is discussed. Finally the impact of steam generator tube degradation upon radiological safety is discussed.

11883 **(CEGB-P—20) Sizewell 'B' power station public inquiry: CEGB proof of evidence. Radioactive waste management.** Passant, F.H. (Central Electricity Generating Board, London (UK)). Nov 1982. 106p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE83703911.

The radioactive wastes expected to arise at the proposed Sizewell B PWR are identified. The plant provided to collect, process, store and dispose of the wastes is described. The quantities and activities of wastes for disposal are derived. The proposed methods of transport and disposal are described. Wastes which would arise from reprocessing and from decommissioning Sizewell B are discussed. Finally some of the radiological aspects of waste disposal are outlined.

11884 **(CEGB-P—24) Sizewell 'B' power station public inquiry: CEGB proof of evidence. Decommissioning.** Gregory, A.R. (Central Electricity Generating Board, London (UK)). Nov 1982. 24p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703898.

The procedure for decommissioning a CEGB nuclear power station is described. Regulatory and licensing procedures in the UK are first listed. The principal sources of radioactivity in the station after final shutdown are classified. The three stages of the decommissioning procedure are then described. Finally the following topics are dealt with briefly: the management of decommissioning wastes, radiological protection during the operation, possible faults arising having radiological significance, design for decommissioning and costs.

11885 **(CEGB-P—25) Sizewell 'B' power station public inquiry: CEGB proof of evidence. Site selection and site specific aspects.** Gammon, K.M. (Central Electricity Generating Board, London (UK)). Nov 1982. 27p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83703899.

The site selection and site specific aspects of the proposal to build Sizewell B GCR are dealt with. A description of the site and its surroundings is followed by physical and technical details of the proposed development. Consultations with statutory authorities, environmental and other local issues are discussed. Finally population distribution around the site and the way in which this could be controlled are considered.

11886 **(CEGB-P—27) Sizewell 'B' power station public inquiry: CEGB proof of evidence. System benefits of the PWR developments at Sizewell and transmission connections.** Arnold, P.J. (Central Electricity Generating Board, London (UK)). Nov 1982. 16p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703900.

The systems benefits of the selection of the Sizewell site for a PWR power station are dealt with. The transmission modifications which would be needed to provide effective connection of this station to the system are considered.

11887 **(CEGB-P—28) Sizewell 'B' power station public inquiry: CEGB proof of evidence. The cooling water system.** Mawer, W.T. (Central Electricity Generating Board, London (UK)). Nov 1982. 21p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703901.

The cooling water system which would be needed for the proposed Sizewell B power station is described. The possible effects upon public safety, local fishing interests and the existing seabed are examined. Studies of the heat dispersion from outfalls, the location of offshore structures and the control of marine growth in the system are reported. Finally the essential service water system, the reserve ultimate heat sink, the discharge of liquid radioactive waste into the sea and the possible use of waste heat for agricultural and fish farming purposes are discussed.

11888 **(CEGB-P—29) Sizewell 'B' power station public inquiry: CEGB proof of evidence. Ecological consequences of the use of cooling water.** Hawes, F.B. (Central Electricity Generating Board, London (UK)). Nov 1982. 25p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703902.

The biological consequences of using a direct cooled system at the proposed Sizewell B power station are dealt with. Problems caused by the impingement of organisms on the fine-mesh screens through which the water is pumped, by the entrainment of smaller organisms in the flow through the cooling system and by the discharge of warmed chlorinated water into the sea are discussed. The chlorination of cooling water is described.

11889 **(CEGB-P—30) Sizewell 'B' power station public inquiry: CEGB proof of evidence. Architecture.** Henderson, B. (Central Electricity Generating Board, London (UK)). Nov 1982. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703903.

Architectural concepts and design proposals associated with the proposed Sizewell B power station are outlined. The figures are in a separate volume. They consist of the site layout plan, an axonometric drawing of the site, an elevations drawing and a colour perspective drawing of 'A', 'B' and 'C' stations.

11890 **(CEGB-P—30/31-Pt.2) Sizewell 'B' power station public inquiry: CEGB architecture and landscape evidence. Figures.** (Central Electricity Generating Board, London (UK)). Nov 1982. 9p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703904.

This volume contains the figures which accompany CEGB P30 Proof of Evidence on Architecture and CEGB P31 Proof of Evidence on Landscape.

11891 **(CEGB-P—31) Sizewell 'B' power station public inquiry: CEGB proof of evidence. Landscape.** Youngman, P. (Central Electricity Generating Board, London (UK)). Nov 1982. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703905.

The scenic effect of the proposed Sizewell B power station is considered. Offsite planting of trees, landscaping of the areas around the new access road and of the site itself are discussed. The landscape designs are in a separate volume.

11892 **(CEGB-P—39) Sizewell 'B' power station public inquiry: CEGB proof of evidence. Fuel management in the PWR.** Anderson, D.W. (Central Electricity Generating Board, London (UK)). Nov 1982. 29p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83703906.

The fuel management scheme of the proposed Sizewell B power station is discussed. It is shown how this could be organized in order to obtain a high winter peak availability.

11893 **(DLCS—5000383) Quarterly operating report. Third quarter 1983.** (Duquesne Light Co., Shippingport, PA (USA)). 1983. Contract AC11-76PN00292. 11p. NTIS, PC A02/MF A01. Order Number DE84005401.

At the beginning of the third quarter of 1983, the Shippingport Atomic Power Station remained shutdown for end of life defueling and decommissioning. In anticipation of fuel movement, the Reactor Pit section of the canal remained full of borated water with the Reactor Pit Gate removed. The 1D Steam Generator and 1D Reactor Loop were isolated and drained in preparation for the inspection. Following the inspection, the 1D Steam Generator and 1D Reactor Loop were refilled. The Reactor loops were cross-connected through the Purification System. Reactor plant system inactivation and turbine plant salvage operations continued and will continue through the fourth quarter of 1983. Defueling efforts continued during the third quarter; twelve seed modules, six reflector modules and two blanket modules were removed from the reactor vessel. Four of the reflector modules have been shipped to the Expended Core Facility in Idaho. The remaining modules were placed in temporary storage at Shippingport Atomic Power Station. The irradiated PWR Core 2 barrel and miscellaneous refueling tools remained in storage under shielding water in the Deep Pit. On-shift casualty and emergency drills were performed during the quarter.

11894 **(DOE/ET/34014—12) Extended fuel burnup demonstration program. Semiannual technical progress report for the period from January 1983-June 1983.** Moss, H.D. (comp.). (Westinghouse Electric Corp., Pittsburgh, PA (USA). Nuclear Energy Systems Div.; Virginia Electric and Power Co., Richmond (USA)). Nov 1983. Contract AC02-79ET34014. 42p. (WCAP—10389). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84003661.

This report describes progress made during the period of January through June 1983 on the Cooperative Extended Fuel Burnup Demonstration Program being carried out by the United States Department of Energy, the Virginia Electric and Power Company, and Westinghouse Electric Corporation. The program is a study of the feasibility of increasing the region average discharge burnup of PWR fuel assemblies to values exceeding 40,000 MWD/MTU as part of the normal fuel cycle, and includes both generic technical studies and data acquisition. Final shipping cask analysis results are reported for the Nuclear Assurance Corporation casks, except for the criticality evaluation of the NAC-3K cask. Calculations to establish maximum fuel enrichments transportable in the Transnuclear, Inc., casks were completed. Design methodologies establishing the parameters controlling the minimum required cooling time for shielding and fission gas releases were reviewed for excess conservatism and revised where appropriate. As part of the burnup meter development, the Fuel Monitoring Fixture was fabricated, assembled, and functionally tested, with satisfactory results.

11895 **(FRNC-TH—1109) Feedback data collections for studying the Fessenheim reactor during its first cycle.** Hassini, A. (Paris-11 Univ., 91 - Orsay (France)). Sep 1982. 172p. (In French). NTIS (US Sales Only), PC A08/MF A01. Order Number DE83704237.

In the work undertaken, feedback associated with a single cell, a fuel assembly and a reactor core is studied. Firstly, cross sections dependent on water density and Doppler effects are investigated in the case of a single fuel cell in different assembly configurations (enrichment, poison). Investigations will be carried out at an irradiation of 12000MWD/t. Under these conditions, appreciable quantities of all the isotopes and fission products generated exist. Complementary studies are undertaken to qualify the simplified feedback model used in DIANE for assemblies in different states. The state of an assembly in the core is characterized by its specific burn up, mean temperatures and soluble boron concentration. The effect of variations in each of these parameters on corrections related to temperature effects are analyzed in order to gain a better understanding of the validity limits of the model. Studies of the FESSENHEIM reactor during its first cycle will be conducted taking feedback effects into account. This is the final aim of the work undertaken. These studies consist of making comparisons between the DIANE calculations and experimental activity mapping measurements on instrumented assemblies using fission chambers to simulate the activity in the assemblies. A synthesis comparison with other work) enables the phenomena occurring to be explained and the tendencies in the calculation-experiment discrepancies to be determined.

11896 **(FRNC-TH—1140) Contribution to the qualification of Gd calculation in PWR reactors.** Chaucheprat, P. (Paris-11 Univ., 91 - Orsay (France)). Jun 1982. 256p. (In French). NTIS (US Sales Only), PC A12/MF A01. Order Number DE83704241.

This thesis presents the state of knowledge on gadolinium and the advantages of its use as burnable poison. A study on the behaviour of gadolinium makes it possible to bring out the essential parameters to which it is sensitive. The most important part of this work is devoted to the measurements by oscillations carried out in Minerve in 1981. The conceiving and implementation of this campaign are reported. The experimental results and the amending factors linked to the interpretation are presented. To complete this study at zero time, it seemed useful to process configurations with fuel clusters of UO_2 - Gd_2O_3 in order to see the effect of UO_2 - Gd_2O_3 rods in interaction. To this end, efficiency determinations of UO_2 - Gd_2O_3 rod clusters were carried out in the Melodie lattice. The second part of this work involves the change in the gadolinium. Two main points are tackled here. The first concerns the determinations by oscillations of "reconstituted" samples that are composed of two concentric rings with various ^{235}U enrichments and gadolinium levels so as to simulate irradiated UO_2 - Gd_2O_3 fuel. The second point is devoted to the description of the GEDEON experiment. UO_2 - Gd_2O_3 rods will be irradiated in a 13 x 13 lattice of which the spectrum is representative of that of a PWR. This experiment will take place in the centre of the Melusine reactor at Grenoble.

11897 **(IAE—3558/5) Approximation of the dependences of the WWER type reactor lattice neutron-physical characteristics on the core state parameters. OKA program.** Zholkevich, E.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1982. 56p. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83703883.

The accuracy is analyzed of determining small-group constants of homogeneous fuel lattices of the WWER type reactors from approximation formulae used in the BIPR - and KR computer codes. New approximation formulae are suggested which lead to a more exact description of the relationship between these constants and the fuel burn-up fraction, boron concentration, coolant temperature, power level, and concentration of ^{135}Xe and ^{149}Sm. The OKA code is described. It is intended for determining the approxi-

mation coefficients to be used in the new formulae. The code is written in the FORTRAN language and adapted for the BESM-6 computer. The formulae suggested are shown to allow a more exact computation of the power release field, reactor operating period and other neutron-physical characteristics of the WWER type reactors.

11898 (INIS-mf—8557, pp 143-149) **Service life tests of primary circuit components of WWER 440 nuclear power plants.** Merta, J.; Svoboda, V. (Sigma, Prague (Czechoslovakia). Vyzkumny Ustav Cerpacich Zarizeni, Potrubi a Armatur). 1980. (In Czech). NTIS (US Sales Only), PC A03/MF A01. (CONF-8010336—Vol.2).

From National ICF conference on structure damage processes and fault diagnostics; Srni, Czechoslovakia (13 Oct 1980).

Service life tests were conducted on a prototype of a seamless bend of 500 mm nominal inside diameter (material 08Kh18N12T) under variable internal overpressure. In the first stage of the tests the internal overpressure changed within the range of 0 to 12.75 MPa, the measurement of stress was conducted on the outer surface after 50 cycles of the given loading. In the second stage of the tests of the bend, the resistance of this part was monitored given an artificial defect under the same strain pattern. In the final stage cyclic strain was increased within the range of 0 to 19.61 MPa; from the 10,000th cycle defects were also monitored using acoustic emission. (H.S.).

11899 (INIS-mf—8557, pp 150-156) **Methodology of assessing the degree of damage of pipe parts of the main circulating circuits of WWER 440 nuclear power plants.** Sedlacek, J.; Svoboda, V. (Ceske Vysoke Uceni Technicke, Prague (Czechoslovakia). Fakulta Jaderna a Fysikalne Inzenyrska); Merta, J. (Sigma, Prague (Czechoslovakia). Vyzkumny Ustav Cerpacich Zarizeni, Potrubi a Armatur). [nd]. (In Czech). NTIS (US Sales Only), PC A03/MF A01. (CONF-8010336—Vol.2).

From National ICF conference on structure damage processes and fault diagnostics; Srni, Czechoslovakia (13 Oct 1980).

The evaluation is made of the process of damaging components using Wald's sequential analysis assuming exponential and normal distributions. The components are made of austenitic steel 0Kh18N12T. (H.S.).

11900 (INIS-mf—8557, pp 235-239) **Service life evaluation of main closing valve body of primary circuit of WWER 440 MW power plant.** Zdarek, J.; Juricek, V.; Pospisil, L. (Sigma, Prague (Czechoslovakia). Vyzkumny Ustav Cerpacich Zarizeni, Potrubi a Armatur). [nd]. (In Czech). NTIS (US Sales Only), PC A03/MF A01. (CONF-8010336—Vol.2).

From National ICF conference on structure damage processes and fault diagnostics; Srni, Czechoslovakia (13 Oct 1980).

A complex experimental and computer investigation was carried out of the state of stress, and the service life was evaluated of the main closing valve for the primary circuits of WWER 440 MW nuclear power plants. The evaluation included all loads prescribed by the customer. The calculations are in good agreement with the Soviet standard for the calcualtion of the components of nuclear power plants. This proved to the full the required service life of the main closing valve.

11901 (INIS-mf—8558, pp 118-132) **Radiation protection of personnel in designing and management of nuclear power installations.** Winkler, R. 1981. (In German). NTIS (US Sales Only), PC A03/MF A01. (CONF-8109240—).

From 7. national conference on power plant chemistry; Usti nad Labem, Czechoslovakia (8 Sep 1981).

An analysis of the current state of the radiation burden of personnel in light water nuclear power plants and a survey of introduced and developed measures for its reduction indicates the complexity of the problem. Doses to personnel will have to be reduced to 20% as compared with the current state. There is a wide range of possibilities ranging from the elimination of primary causes to organizational measures. A satisfactory solution can only be brought about by an economically optimized system of well-founded measures. (Ha).

11902 (INIS-mf—8558, pp 35-43) **Use of boric acid in WWER type reactors.** Kysela, J. 1981. (In Czech). NTIS (US Sales Only), PC A03/MF A01. (CONF-8109240—).

From 7. national conference on power plant chemistry; Usti nad Labem, Czechoslovakia (8 Sep 1981).

The use of boric acid in the coolant of the primary circuit of PWR type reactors has a negative effect on the cleaning ability of ion exchangers, mainly of anion exchangers. The properties were tested of highly basic anion exchangers manufactured by different producers in a solution containing 5 $g.l^{-1}$ H_3BO_3. The decrease in capacity due to gamma irradiation of highly acidic cation exchanger KU-2-8-CS and of highly basic anion exchanger AV-17-8-CS of Soviet provenance was tested. The analysis showed that highly basic anion exchangers are suitable for reducing the concentration of H_3BO_3 in the coolant towards the end of the campaign and for controlling the content of H_3BO_3 (for compensation of xenon poisoning in output changes) by making use of the increase in exchanger distribution constant with decreasing temperature.

11903 (KFKI—1983-36) **Theoretical description of the reactor noise in a strongly coupled reactor kinetic-thermohydraulic system.** Mesko, L.; Katona, T. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Apr 1983. 20p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704342.

The coupled neutronkinetic-thermohydraulic noise phenomena in a core of a PWR has been investigated. The theoretical model derived from the Markovian description of the multi-variable system anables to calculate the auto-and cross power spectral densities and compare them with and without subcooled boiling.

11904 (ND-R—789(R)) **RNL studies on the application of ultrasonics to reactor pressure vessel inspection.** Murgatroyd, R.A.; Bell, I.P.; Rogerson, A. (UKAEA Risley Nuclear Power Development Establishment). Jul 1982. 25p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703884.

The status of the NDT development studies being carried out in RNL for the PWR Safety Research Programme is described and important aspects and results are summarised. The results of applying the RNL inspection system to a full-thickness, clad, testplate are outlined, and the significance of search sensitivity on defect detection using pulse-echo is reported. The status of studies to develop advanced sizing techniques is given together with examples of their application. Detection and sizing techniques for near-surface defects have been developed for and tested in the Defect Detection Trials and the status of the development work is described. The effect of austenitic strip cladding on the propagation of ultrasound has been studied in the RNL programme and the importance of surface finish has been demonstrated.

11905 (ND-R—912(R)) **Final report on the UKAEA defect detection trials on test pieces 3 and 4. December 1982.** Lock, D.L.; Cowburn, K.J. (UKAEA Risley Nuclear Power Development Establishment). Mar 1983. 51p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE83704343.

The report follows ND-R-845(R) which described the scope, inspection procedures and results of the defect detection trials on test pieces 3 and 4. The work has been aimed at assessing the ability of non-destructive testing techniques, to detect and size defects near the clad/base metal interface of a flat piece and the inner radius of a PWR inlet nozzle. Following the destructive examination of the test pieces at Ispra, the true sizes of the intended defects are now known. These sizes are compared with that intended and the performance of the inspection teams reviewed.

11906 (SAND—83-1682) **Sequoyah Unit 1 charge converter examination results.** Murphy, M.B. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1983. Contract AC04-76DP00789. 15p. NTIS, PC A02/MF A01. Order Number DE84005879.

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The accident at Three Mile Island subjected loose parts monitoring system charge converters to moderate levels of radiation that caused them to fail. Two charge converters exhibiting similar failure symptoms were removed from an operating plant, Sequoyah Unit 1, and examined to determine their failure modes and to estimate the total radiation doses received by each. Radiation degradation of the circuit was found to be highly dependent on the value of a select resistor.

11907 **(ZJE—257) Acoustical diagnostics of boiling.** Liska, J. (Skoda, Plzen (Czechoslovakia). Zavod Vystavba Jadernych Elektraren). 1982. 16p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703885.

The possibility is studied of using acoustic detection of boiling in the pressurized reactor core. Relations are analyzed between the basic thermal and physical quantities and the intensity of the acoustic signal emitted during surface boiling. The successful application of this method of detecting the formation and propagation of surface boiling in a channel with flowing water depends on the signal-to-noise ratio value.

11908 **(ZJE—258) Possibilities and limitations of monitoring mechanical vibrations.** Pecinka, L. (Skoda, Plzen (Czechoslovakia). Zavod Vystavba Jadernych Elektraren). 1982. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703886.

The philosophy and main principles are described of current mathematical models for the description of mechanical vibrations of parts of PWR reactors. All mathematical models proceed from a common equation of motion and replace actual systems with many degrees of freedom by simpler systems. This determines the possibilities of diagnosing mechanical vibrations. The main restrictions for monitoring mechanical vibrations are due to the relationship between the monitoring system and the superior system. These restrictions include the relatively long computation times for the solution of the equation of motion in case stress analysis is required, the uncertainty in calculating crack propagation given by the nonlinear character of the task, and possibilities of computater technology and hardware.

11909 **Gamma thermometer based reactor core liquid level detector.** Burns, T.J. (to Dept. of Energy). US Patent 4,406,011. 20 Sep 1983. Filed date 16 Jun 1981. vp.

PAT-APPL-274121.

A system is provided which employs a modified gamma thermometer for determining the liquid coolant level within a nuclear reactor core. The gamma thermometer which normally is employed to monitor local core heat generation rate (reactor power), is midified by thermocouple junctions and leads to obtain an unambiguous indication of the presence or absence of coolant liquid at the gamma thermometer location. A signal processor generates a signal based on the thermometer surface heat transfer coefficient by comparing the signals from the thermocouples at the thermometer location. The generated signal is a direct indication of loss of coolant due to the change in surface heat transfer when coolant liquid drops below the thermometer location. The loss of coolant indication is independent of reactor power at the thermometer location. Further, the same thermometer may still be used for the normal power monitoring function.

2103 Power Reactors, Non-breeding, Graphite Moderated

REFER ALSO TO CITATION(S) 11564, 11880, 12654

11910 **(AERE-R—10849) Development of a CVD silica coating for UK advanced gas-cooled nuclear reactor fuel pins.** Bennett, M.J.; Houlton, M.R.; Moore, D.A.; Foster, A.I.; Swidzinski, M.A.M. (UKAEA Atomic Energy Research Establishment, Harwell. Materials Development Div.). Apr 1983. 9p. (CONF-8305134—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704349.

From 4. European conference on CVD; Eindhoven, Netherlands (31 May 1983).

Vapour deposited silica coatings could extend the life of the 20% Cr/25% Ni niobium stabilised (20/25/Nb) stainless steel fuel cladding of the UK advanced gas cooled reactors. A CVD coating process developed originally to be undertaken at atmospheric pressure has now been adapted for operation at reduced pressure. Trials on the LP CVD process have been pursued to the production scale using commercial equipment. The effectiveness of the LP CVD silica coatings in providing protection to 20/25/Nb steel surfaces against oxidation and carbonaceous deposition has been evaluated.

11911 **(GA-A—16757) HTGR Fuel Technology Program. Semiannual report for the period ending March 31, 1982.** (GA Technologies, Inc., San Diego, CA (USA)). Jun 1982. Contract AT03-76ET35300. 75p. NTIS, PC A04/MF A01. Order Number DE84006217.

Activities include the fuel process, fuel materials, fuel cycle, fission product transport, and core component verification testing tasks necessary to support the design and development of a system cycle/cogeneration (SC/C) version of the HTGR with a follow-on reformer (R) version. An important effort which was initiated during this period was the preparation of input data for a long-range technology program plan.

11912 **(GA-A—17337) US/FRG umbrella agreement for cooperation in GCR development. Fuel, fission products, and graphite subprogram, quarterly status report, July 1, 1983-September 30, 1983.** Turner, R.F. (GA Technologies, Inc., San Diego, CA (USA)). Oct 1983. Contract AT03-76ET35300. 22p. NTIS, PC A02/MF A01. Order Number DE84005638.

ORNL has prepared a first draft of a summary report on performance of low-enriched uranium (LEU) fuel particles. A core heatup simulation test at 1600°C for 186 hours was performed at GA on HOBEG LEU TRISO fuel particles from test element DR-S6. Technical data on fuel processes were exchanged during a visit. Comprehensive information on fuel data storage and retrieval systems was exchanged during a visit. Preliminary test conditions were defined for a fuel irradition capsule test in HFR-Petten capsule, starting in 1985. GA issued a report on the evaluation of differences between models by the US and FRG on release of gaseous fission products from fuel particles. US and FRG graphite specimens were included in fracture mechanics tests in the ORNL capsules HTF-1, -2, and -3. The shakedown test of the Core Support Post Test loop was completed at ORNL with no graphite specimens in the test chamber. The control of temperature flow rates and coolant impurity levels was demonstrated.

11913 **(IAEA-TC—389/6-7) Temperature measurement: Development work on noise thermometry and improvement of conventional thermocouples for applications in nuclear process heat (PNP).** Brixy, H.; Hecker, R.; Oehmen, J.; Barbonus, P.; Hans, R. (International Atomic Energy Agency, Vienna (Austria); Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung; Internationale Atomreaktorbau G.m.b.H. (INTERATOM), Bergisch Gladbach (Germany, F.R.)). Jun 1982. 12p. (CONF-820653—25). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704356.

From IAEA specialists' meeting on gas-cooled reactor core and high temperature instrumentation; Cumbria, UK (15 Jun 1982).

The behaviour was studied of NiCr-Ni sheathed thermocouples (sheath Inconel 600 or Incoloy 800, insulation MgO) in a helium and carbon atmosphere at temperatures of 950-1150 deg. C. All the thermocouples used retained their functional performance. The insulation resistance tended towards a limit value which is dependent on the temperature and quality of the thermocouple. Temperature measurements were loaded with great uncertainty in the temperature range of 950-1150 deg. C. Recalibrations at the temperature of 950 deg. C showed errors of up to 6%. Measuring sensors were developed which consist of a sheathed double thermocouple with a noise resistor positioned between the two hot junctions. Using the noise thermometer it is possible to recalibrate the thermocouple at any time in situ. A helium system with a high temperature experimental area was developed to test the thermocouples and the combined thermocouple-noise thermometer sensors under true experimental conditions.

11914 **(IAEA-TC—389/6-22) Requirements of, and operating experience with, gas analyses on high temperature reactors.** Nieder, R. (International Atomic Energy Agency, Vienna (Austria); Arbeitsgemeinschaft Versuchs-Reaktor G.m.b.H., Juelich (Germany, F.R.)). Jun 1982. 16p. (CONF-820653—23). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704350.

From IAEA specialists' meeting on gas-cooled reactor core and high temperature instrumentation; Cumbria, UK (15 Jun 1982).

Impurities in the helium coolant of the primary coolant circuit of HTGR's are mainly due to ingress of air or water, occasionally oil. Typical concentrations are given of H_2O, H_2, CO_2, CO, N_2, CH_4 and Ar in the AVR, Dragon, Peach Bottom and Fort St. Vrain reactors. A characteristic is presented of measuring devices for measuring non-active impurities in helium; measuring methods are described and a list is given of required and actual detection limits. Also given are concentrations of solid fission and activation products and tritium in the primary circuit of the AVR reactor.

2104 Power Reactors, Non-breeding, Otherwise Moderated Or Unmoderated

REFER ALSO TO CITATION(S) 12030

11915 **(AEEW-M—1959) Analysis, using the CLAP-TRAP code, of the pressure transients developed in the Carolinas Virginia Tube Reactor during containment performance tests.** Porter, W.H.L. (UKAEA Atomic Energy Establishment, Winfrith). Nov 1982. 13p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703882.

To check containment performance of the CVTR, steam was injected above the operating floor through a 10 foot pipe cap containing the 1 inch diameter holes, at a steady rate of 102.8 lb/sec for a period of 166 seconds. This steam had an enthalpy of 1195 Btu/lb and was therefore not entirely typical of the much wetter material which would be rejected for the greater part of a true breached circuit accident. Pressure transients measured experimentally within the containment were compared with results calculated by the American code CONTEMPT and these results in turn have allowed the Winfrith code CLAPTRAP to be tested for consistency and to establish that the use of this code would have led to similar conclusions about the heat transfer coefficients at the heat absorbent surfaces.

2105 Power Reactors, Breeding

REFER ALSO TO CITATION(S) 11561, 11564, 11968, 11969, 11970, 11975, 11983, 12011, 12021, 12060, 12406, 12431, 12953

11916 **(CEA-CONF—6735) Basic nuclear data for FBR fuel cycle. Balance and forecasting.** Costa, L.; Granget, G.; Josso, F. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France)). 1982. 25p. (In French). (CONF-820942—38). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750428.

From Nuclear data for science and technology international conference; Antwerp, Belgium (6 Sep 1982).

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A balance is made of nuclear data needed for studying FBR fuel cycle. From the accuracy of the obtained data, sensitivity calculations have enabled the future experimental measurements to be established.

11917 **(CEA-CONF—6829) In-service inspection in the Superphenix 1 vessels interspace.** Asty, M.; Saglio, R. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Mar 1983. 12p. (In French). (CONF-8303111—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750432.

From Meeting of the Society of Electrical, Electronic and Radio Engineers; Creys-Malville, France (17 Mar 1983).

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The design of Superphenix 1 reactor vessels allows their in-service inspection. A self-propelling engine, the MIR, has been conceived for this need: it can do a visual and ultrasonic inspection. The MIR can move in the whole vessels interspace. The operating conditions are specified and the principle characteristics of the MIR engine are presented.

11918 **(DOE/ET/37240—104TR) Application of the MIT two-channel model to predict flow recirculation in WARD 61-pin blanket tests.** Huang, T.T.; Todreas, N.E. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Nuclear Engineering). Jan 1983. Contract AC02-76ET37240. 71p. NTIS, PC A04/MF A01. Order Number DE84004538.

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The preliminary application of MIT TWO-CHANNEL MODEL to WARD sodium blanket tests was presented in this report. Our criterion was employed to predict the recirculation for selected completed (transient and steady state) and proposed (transient only) tests. The heat loss was correlated from the results of the WARD zero power tests. The calculational results show that our criterion agrees with the WARD tests except for WARD RUN 718 for which the criterion predicts a different result from WARD data under bundle heat loss condition. However, if the test assembly is adiabatic, the calculations predict an operating point which is marginally close to the mixed-to-recirculation transition regime.

11919 **(DOE/SF/01011—T25-Vol.1) Seismic design technology for breeder reactor structures. Volume 1. Special topics in earthquake ground motion.** Reddy, D.P. (Agbabian Associates, El Segundo, CA (USA)). Apr 1983. Contract AC03-76SF01011;W-7405-ENG-26. 275p. NTIS, PC A12/MF A01. Order Number DE84004808.

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This report is divided into twelve chapters: seismic hazard analysis procedures, statistical and probabilistic considerations, vertical ground motion characteristics, vertical ground response spectrum shapes, effects of inclined rock strata on site response, correlation of ground response spectra with intensity, intensity attenuation relationships, peak ground acceleration in the very mean field, statistical analysis of response spectral amplitudes, contributions of body and surface waves, evaluation of ground motion characteristics, and design earthquake motions. (DLC)

11920 **(DOE/SF/01011—T25-Vol.2) Seismic design technology for breeder reactor structures. Volume 2. Special topics in soil/structure interaction analyses.** Reddy, D.P. (Agbabian Associates, El Segundo, CA (USA)). Apr 1983. Contract AC03-76SF01011;W-7405-ENG-26. 134p. NTIS, PC A07/MF A01. Order Number DE84004809.

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This volume is divided into six chapters: definition of seismic input ground motion, review of state-of-the-art procedures, analysis guidelines, rock/structure interaction analysis example, comparison of two- and three-dimensional analyses, and comparison of analyses using FLUSH and TRI/SAC Codes. (DLC)

11921 **(DOE/SF/01011—T25-Vol.4) Seismic design technology for breeder reactor structures. Volume 4. Special topics in piping and equipment.** Reddy, D.P. (Agbabian Associates, El Segundo, CA (USA)). Apr 1983. Contract AC03-76SF01011;W-7405-ENG-26. 215p. NTIS, PC A10/MF A01. Order Number DE84004811.

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This volume is divided into five chapters: experimental verification of piping systems, analytical verification of piping restraint systems, seismic analysis techniques for piping systems with multi-support input, development of floor spectra from input response spectra, and seismic analysis procedures for in-core components. (DLC)

11922 **(FRNC-TH—1132) Definition and validation of a calculation method (neutronic formulaire) used to investigate the properties of fast neutron reactor blankets.** Soule, R. (Paris-11 Univ., 91 - Orsay (France)). Oct 1982. 232p. (In French). NTIS (US Sales Only), PC A11/MF A01. Order Number DE83704238.

This thesis presents basic cross section data set processing and flux distribution methods ("formulaire"), which may be used to calculate the properties of fast neutron reactor blankets. This formulaire is a part of the global calculation method used to study the whole reactor core. The approach adopted consists in studying successively: - the approximations of the multigroup cross sections processing methods and of the spatial and energy neutron flux calculation methods, together with their validation, based on calculation/experiment comparison; - the consequences of the basic data uncertainties on blanket integral parameters calculations. Finally, we apply the formulaire to the analysis of an experiment performed in the PHENIX power reactor (Pu production measurement in the first fertile subassembly ring).

11923 **(FRNC-TH—1142) Numerical solution of three-dimensional Navier-Stokes equations: application to the deflected jet problem.** Ravier, P. (Ecole Centrale Lyonnaise, 69 - Ecully (France)). Oct 1982. 106p. (In French). NTIS (US Sales Only), PC A06/MF A01. Order Number DE83704239.

The core of a nuclear breeder is made up of a group of fertile and fuel assemblies irrigated by a coolant fluid intended to recuperate and transmit the calorific power produced by the core to a system of exchangers. The coolant fluid gushes forth at the top of the core as a set of jets deflected by the radial flow resulting from the presence of the core lid. The area above the core is the seat of a complex flow. This area is fitted with instrumentation to monitor the behaviour of the reactor. The purpose of this thesis is to define and build a calculation tool that will describe complex semi-confined three dimensional flows, based essentially on very neighbouring jets and subjected to an external flow.

11924 **(HEDL-SA—2850) Simplified method evaluation for piping elastic follow-up.** Severud, L.K. (Hanford Engineering Development Lab., Richland, WA (USA)). May 1983. Contract AC06-76FF02170. 32p. (CONF-840926—1). NTIS, PC A03/MF A01. Order Number DE84003988.

From 5. international conference on pressure vessel technology; San Francisco, CA, USA (9 Sep 1984).

A proposed simplified method for evaluating elastic follow-up effects in high temperature pipelines is presented. The method was evaluated by comparing the simplified analysis results with those obtained from detailed inelastic solutions. Nine different pipelines typical of a nuclear breeder reactor power plant were analyzed; the simplified method is attractive because it appears to give fairly accurate and conservative results. It is easy to apply and inexpensive since it employs iterative elastic solutions for the pipeline coupled with the readily available isochronous stress-strain data provided in the ASME Code.

11925 **(NE-C—8-6T-Rev.(11/83)) Hydrogen meter for service in liquid sodium.** McCown, J.J. (Department of Energy, Washington, DC (USA). Office of Nuclear Energy Programs). Nov 1983. 28p. Nuclear Standards Management Center, Oak Ridge, TN 37830.

This standard establishes the requirements for the design, materials, fabrication, quality assurance, examination, and acceptance testing of a hydrogen meter and auxiliary equipment for use in radioactive or nonradioactive liquid sodium service. The meter shall provide a continuous and accurate indication of the hydrogen impurity concentration over the range 0.03 to 10 ppM hydrogen in sodium at temperatures between 800 and 1000°F (427 and 538°C). The meter may also be used to rapidly monitor changes in hydrogen concentration, over the same concentration range, and, therefore can be used as a sensor for sodium-water reactions in LMFBR steam generators.

11926 **Reprocessing in breeder fuel cycles.** Burch, W.D.; Groenier, W.S. (Oak Ridge National Laboratory, Fuel Recycle Division, P.O. Box X, Oak Ridge, Tennessee 37830). *Nuclear Technology;* **61**: No. 3, 388-397(Jun 1983).

Over the past decade, the United States has developed plans and carried out programs directed toward the demonstration of breeder fuel reprocessing in connection with early breeder demonstration reactors. Although subject to continuing debate, progress continued on the construction of the Clinch River Breeder Reactor (CRBR) with startup anticipated near the end of this decade, while plans for the CRBR and its associated fuel cycle are still being firmed up, the basic R & D programs required to carry out the demonstrations have continued. Policies call for breeder recycle to begin in the early to mid-1990s. An important objective of the reprocessing program is to develop advanced technology for the recovery of fissile materials in systems that minimize environmental emissions and doses to plant workers, and that also provide effective fissile material safeguards. Major improvements include technology for remote operation and maintenance, low-flow ventilation systems coupled with more effective off-gas treatment, and advanced process monitoring for control and safeguards.

11927 **Modeling of internal tubing and supports in an LMFBR steam generator.** Pedani, A.J.; Figliomeni, F.J. (Babcock and Wilcox, Barberton, OH). *American Society of Mechanical Engineers, [Paper];* **82-JPGC-NE-10**: 6(1982). (CONF-821018—). Contract AC02-77ET37209.

From IEEE/ASME/ASCE joint power generation conference; Denver, CO, USA (17 Oct 1982).

This paper presents the detailed finite element modeling used in performing an analysis of internal tubing within a helically coiled Liquid Metal Fast Breeder Reactor (LMFBR) Steam Generator. It provides a qualitative approach to account for the effects of tube and clamp interaction loads resulting from differential thermal expansion and seismic loadings. The model is also used to describe the natural frequency characteristics of the entire tube system for evaluation of flow-induced vibration loadings.

11928 **Modeling considerations for the analysis of LMFBR steam generator tube clamps.** Lay, D.M.; Piper, R.M. (Babcock and Wilcox, Barberton, OH). *American Society of Mechanical Engineers, [Paper];* **82-JPGC-NE-9**: 6(1982). (CONF-821018—). Contract AC02-77ET37209.

From IEEE/ASME/ASCE joint power generation conference; Denver, CO, USA (17 Oct 1982).

In the design of the Babcock & Wilcox Helical Coil Liquid Metal Fast Breeder Reactor (LMFBR) Steam Generator, the tube bundle is connected to the feedwater and steam plenums via "inlet/outlet tubes". Of prime importance in the design of these tubes is the tube-to-tube and tube-to-shell clamps which are provided to prevent detrimental vibration. This paper presents a method of modeling the tube-to-tube clamps to accurately predict tube-to-clamp interaction in the finite element analysis. It also demonstrates the validity of specific modeling assumptions in determining stresses in the clamp assembly.

11929 **Combining fusion with fission for the benefit of the energy economy.** Greenspan, E.; Miley, G.H. (Univ. of Illinois, Urbana). pp 161-165 of Proceedings of the IASTED energy symposia: modelling, policy and economics of energy and power systems; alternative energy sources and technology. Hamza, M.H. (ed.). Anaheim, CA; ACTA Press (1981). (CONF-810574—).

From International Association of Science and Technology for Development energy symposium; San Francisco, CA, USA (20 May 1981).

By combining fusion with fission in the form of hybrid reactors it might be possible to alleviate major difficulties to be faced by the energy economy much better than by using fission-only and fusion-only reactors. It is estimated that few dozens GWth of Hybrid Fuel Factories (HFFs) could provide most of the fissile fuel needs of the fission energy economy by the year 2025. With the hybrid support, it is possible to expand the capacity of nuclear power reactors to replace coal-fired power plants, thus, significantly reducing the demand for coal and thus alleviating a second major difficulty of the energy economy. Semi-catalyzed deuterium fusion reactors for the co-generation of synthetic fuels and ^{3}He are proposed for the next phase. The ^{3}He is to provide the fuel for the relatively clean D-^{3}He fusion-power economy. 21 references, 1 figure.

11930 **Automated fuel pin loading system.** Christiansen, D.W.; Brown, W.F.; Steffen, J.M. US Patent Application 6-445,640. [nd]. 51p. Contract AC06-76FF02170.

An automated loading system for nuclear reactor fuel elements utilizes a gravity feed conveyor which permits individual fuel pins to roll along a constrained path perpendicular to their respective lengths. The individual lengths of fuel cladding are directed onto movable transports, where they are aligned coaxially with the axes of associated handling equipment at appropriate production stations. Each fuel pin can be be reciprocated axially and/or rotated about its axis as required during handling steps. The fuel pins are inerted as a batch prior to welding of end caps by one of two disclosed welding systems.

2106 Power Reactors, Auxiliary, Mobile, Package, And Transportable

REFER ALSO TO CITATION(S) 11947

11931 **(CONF-840113—3) Behavior of mixed-oxide fuel subjected to multiple thermal transients.** Fenske, G.R.; Hofman, G.L.; Neimark, L.A.; Poeppel, R.B. (Argonne National Lab., IL (USA)). Nov 1983. Contract W-31-109-ENG-38. 36p. NTIS, PC A03/MF A01. Order Number DE84005409.

From Symposium on space nuclear power systems; Albuquerque, NM, USA (10 Jan 1984).

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The microstructural behavior of irradiated mixed-oxide fuel subjected to multiple, mild thermal transients was investigated using direct electrical heating. The results demonstrate that significant intergranular porosity, accompanied by large-scale (>90%) release of the retained fission gas, developed as a result of the cyclic heating. Microstructural examination of the fuel indicated that thermal-shock-induced cracking of the fuel contributed significantly to the increased swelling and gas release.

11932 **(CONF-840113—4) Liquid metal heat transfer issues.** Hoffman, H.W.; Yoder, G.L. (Oak Ridge National Lab., TN (USA)). Jan 1984. Contract W-7405-ENG-26. 26p. NTIS, PC A03/MF A01. Order Number DE84005539.

From Symposium on space nuclear power systems; Albuquerque, NM, USA (10 Jan 1984).

An alkali liquid metal cooled nuclear reactor coupled with an alkali metal Rankine cycle provides a practicable option for space systems/missions requiring power in the 1 to 100 MW(e) range. Thermal issues relative to the use of alkali liquid metals for this purpose are identified as these result from the nature of the alkali metal fluid itself, from uncertainties in the available heat transfer correlations, and from design and performance requirements for system components operating in the earth orbital microgravity environment. It is noted that, while these issues require further attention to achieve optimum system performance, none are of such magnitude as to invalidate this particular space power concept.

2107 Regulation And Licensing

REFER ALSO TO CITATION(S) 11874, 11875, 11878, 11881, 11882, 11884, 11885, 12014, 12042, 12044, 12046, 12049, 12050, 12062, 12064, 12071

11933 **(INIS-mf—8209) Development of costs in connection with the activity of the control and licensing authority.** (Deutsches Atomforum e.V., Bonn (Germany, F.R.). Arbeitskreis 1 - Technik und Industrie). 1982. 12p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704242.

Since 1969 (date of order of 'Biblis A'), the immediate cost of creation of nuclear power plants (excepting interest rate etc.) has risen more than sixfold, corresponding to about 17% p.a. An essential cause of these increases are, and have been, serious abstracts arising from the licensing procedure in its various stages. Thus the construction is delayed, which in itself causes considerable increases in the Construction cost. The call for partly expensive new safety devices, the continuous multiplication of and ever greater demands on proofs, which, in their turn, are followed by calls for additional equipment, trigger off chain reactions of proofs required, schedules missed and additional equipment installed, which hinder the progress of construction of individual projects or even bring it almost to a standstill. Neither this increased expenditure, nor the mountains of paper accumulated in licensing procedures are equivalant to a gain in safety. If greater damage, above all to the national economy, be avested, there is need to take decisions again more largely, on the Gasis of a cost-and-benefit analysis.

11934 **(NE—01-84-Master-Index) Nuclear Standards Master Index.** (Department of Energy, Washington, DC (USA). Office of Nuclear Energy Programs). 20 Jan 1984. 57p. Nuclear Standards Management Center, Oak Ridge, TN 37831.

This index provides a complete list, organized by standard numbers, of all assigned NE numbers, their title, issue date, amendment number and date, issue date of the superseded standard if any, standard writer/cognizant engineer, DOE/cognizant engineer, and a remark column which reflects the current status of the standard (see legend). This January 1984 issue covers July through December 1983. The Nuclear Energy Standards KWIC Index of NE standards, also published by the Nuclear Standards Program Information Center, should be consulted for information on standards when the assigned numbers are not known.

11935 **(NUREG—0304-Vol.8-No.3) Regulatory and technical reports. Compilation for third quarter 1983 July-September. Volume 8, No.3.** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Technical Information and Document Control). Nov 1983. 144p. NTIS, PC A07/MF A01 - GPO. Order Number DE84900688.

This compilation lists all NRC regulatory and technical reports published under the NUREG series during the third quarter of 1983.

11936 **(NUREG—0485-Vol.5-No.11) Systematic Evaluation Program. Status summary report. Volume 5, No. 11.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Resource Management). 30 Nov 1983. 73p. NTIS, PC A04/MF A01 - GPO. Order Number DE84900656.

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The Systematic Evaluation Program is intended to examine many safety-related aspects of 11 of the older light water reactors. This document provides the existing status of the review process including individual topic and overall completion status.

11937 **(NUREG—0540-Vol.5-No.8) Title list of documents made publicly available, August 1-31, 1983. Volume 5, No.8.** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Technical Information and Document Control). Oct 1983. 653p. NTIS, PC A99/MF A01 - GPO. Order Number DE84900708.

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This document is a monthly publication containing descriptions of information received and generated by the US NRC. This information includes: (1) docketed material associated with civilian nuclear power plants and other uses of radioactive materials; and (2) nondocketed material received by NRC pertinent to its role as a regulatory agency. The following indexes are included: Personal Author Index, Corporate Source Index, Report Number Index, and Cross Reference to Principal Documents Index.

11938 **(NUREG—0748-Vol.3-No.9) Operating reactors licensing actions summary, September 1-30, 1983. Vol. 3, No. 9.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Resource Management). Nov 1983. 345p. NTIS, PC A15/MF A01 - GPO. Order Number DE84900711.

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This report is designed to provide the management of the Nuclear Regulatory Commission (NRC) with an overview of licensing actions dealing with operating power and nonpower reactors.

11939 **(NUREG—0748-Vol.3-No.10) Operating reactors licensing actions summary. Volume 3, No. 10.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Resource Management). Dec 1983. 326p. NTIS, PC A15/MF A01 - GPO. Order Number DE84900595.

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The operating reactors licensing actions summary is designed to provide the management of NRC with an overview of licensing actions dealing with operating power and nonpower reactors.

11940 **(NUREG—0748-VOL.3-NO.12) Operating reactors licensing actions summary, December 1-31, 1983. Volume 3, No. 12.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Resource Management). Jan 1984. 333p. NTIS, PC A15/MF A01. Order Number DE84900640.

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This document is designed to provide the Management of the Nuclear Regulatory Commission (NRC) with an overview of licensing actions dealing with operating power and nonpower reactors. It is divided into the following sections: management overview report, multiplant action overview, routine (non-NUREG-0737) licensing action summary, NUREG-0737 licensing actions, condensed management report of licensing actions by power reactors, and multiplant action description for selected active issues.

11941 **(NUREG—0750-Vol.17-Index.2) Indexes to Nuclear Regulatory Commission issuances, January-June 1983. Volume 17, Index 2.** (Nuclear Regulatory Commission, Washington, DC (USA)). Oct 1983. 121p. NTIS, PC A06/MF A01 - GPO. Order Number DE84900724.

Digests and indexes for issuances of the Commission (CLI), the Atomic Safety and Licensing Appeal Panel (ALAB), the Atomic Safety and Licensing Board Panel (LBP), the Administrative Law Judge (ALJ), the Directors' Decisions (DD), and the Denials of Petitions of Rulemaking are presented in this document. These digests and indexes are intended to serve as a guide to the issuances. Information elements common to the cases heard and ruled upon are: Case name (owners of facility); full text reference (volume and pagination); issuance number; issues raised by appellants; legal citations (cases, regulations, and statutes); name of facility, Docket number; subject matter of issues and/or rulings; type of hearing (for construction permit, operating license, etc.); and type of issuance (memorandum, order, decision, etc.).

11942 **(NUREG—0940-Vol.2-No.3) Enforcement actions: significant actions resolved. Quarterly progress report, July-September 1983. Volume 2, No.3.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Inspection and Enforcement). Nov 1983. 585p. NTIS, PC A25/MF A01. Order Number DE84900698.

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This compilation summarizes significant enforcement actions that have been resolved during one quarterly period (July-September 1983) and includes copies of letters, Notices, and Orders sent by the Nuclear Regulatory Commission to licensees with respect to these enforcement actions ad licensees' responses. This and future issues will include cases involving Severity Level III violations for which no civil penalty was assessed. It is anticipated that the information in this publication will be widely disseminated to managers and employees engaged in activities licensed by the NRC, in the interest of promoting public health and safety as well as common defense and security.

11943 **(NUREG—0957) Price-Anderson Act - the third decade. Report to Congress.** Saltzman, J. (Nuclear Regulatory Commission, Washington, DC (USA)). Dec 1983. 220p. NTIS, PC A10/MF A01 - GPO $6.50. Order Number DE84900696.

Subsection 170p. of the Atomic Energy Act of 1954, as amended, requires that the Commission submit to the Congress by August 1, 1983, a detailed report on the need for continuation or modification of Section 170 of the Act, the Price-Anderson provisions. The report is divided into four sections with detailed subject reports appended to the main report. Sections I through III include an examination of issues that the Commission was required by statute to study (i.e., condition of the nuclear industry, state of knowledge of nuclear safety, and availability of private insurance), and discussion of other issues of interest and importance to the Congress and to the public. The subjects covered are as follows: (1) overview of the Price-Anderson system; (2) the state of knowledge of nuclear safety; (3) availability of private insurance; (4) conditions of the nuclear industry; (5) causality and proof of damages; (6) limitation of liability and subsidy; and (7) a proposal that would provide for removal of the limitation of liability but with limited annual liability payments. Section IV of the report contains conclusions and recommendations. Section V contains a bibliography.

11944 **(NUREG—1009) Technical specifications WPPSS Nuclear Project No. 2 (Docket No. 50-397). Appendix A to License No. NPF-21.** Hoffman, D.R. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Dec 1983. 481p. NTIS, PC A21/MF A01 - GPO $9.50. Order Number DE84900664.

The WPPSS Nucelar Project No. 2 Technical Specifications were prepared by the US Nuclear Regulatory Commission to set forth the limits, operating conditions, and other requirements applicable to a nuclear reactor facility as set forth in Section 50.36 of 10 CFR Part 50 for the protection of the health and safety of the public.

11945 **(NUREG/CR—3568) Handbook for value-impact assessment.** Heaberlin, S.W.; Burnham, J.B.; Gallucci, R.H.V.; Mullen, M.F.; Nesse, R.J.; Nieves, L.A.; Tawil, J.J.; Triplett, M.B.; Weakley, S.A.; Wusterbarth, A.R. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1983. Contract AC06-76RL01830. 153p. (PNL—4646). NTIS, PC A08/MF A01 - GPO $5.50. Order Number DE84004656.

The basic purpose of this handbook is to document a set of systematic procedures for providing information that can be used in performing value-impact assessments of Nuclear Regulatory Commission (NRC) regulatory actions. The handbook describes a structured but flexible process for performing the assessment. Chapter 1 is an introduction to the value-impact assessment process. Chapter 2 describes the attributes most frequently affected by proposed NRC actions, provides guidance concerningthe appropriate level of effort to be devoted to the assessment, suggests a standard format for documenting the assessment, and discusses the treatment of uncertainty. Chapter 3 contains detailed methods for evaluating each of the attributes affected by a regulatory action. The handbook has five appendixes containing background information, technical data, and example applications of the value-impact assessment procedures. This edition of the handbook focuses primarily on assessing nuclear power reactor safety issues.

2108 Economics

REFER ALSO TO CITATION(S) 11929, 12124, 12152

11946 **Nuclear plant cancellations: costs and consequences.** *Energy (Stamford, Connecticut);* 8: No. 4, 9-11(Sum 1983).

Approximately half of the total commercial nuclear plant capacity ordered since the inception of commercial nuclear power has been cancelled, inflicting a substantial cost burden on the nation. The great majority of cancellation costs have been levied upon utility ratepayers and taxpayers, who had little or no control over the planning and construction of power plants.

2109 Process Heat Reactors

11947 **SMR: a small mass produced reactor for electricity and process heat.** Powell, J.R.; Botts, T.E.; Lazareth, O.W.; Usher, J.L. (Brookhaven National Lab., Upton, NY). pp 612-613 of 5th Miami international conference on alternative energy sources. Vezirogla, T.N. (ed.). Coral Gables, FL; Univ. of Miami (1983). (CONF-821213—).

From 5. international conference on alternative energy source; Miami Beach, FL, USA (13 Dec 1982).

22 NUCLEAR REACTOR TECHNOLOGY

2201 Theory And Calculation

11948 **(AEEW-M—1999) Treatment of burnable poison pins in LWRWIMS.** Halsall, M.J. (UKAEA Atomic Energy Establishment, Winfrith). Dec 1982. 23p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703888.

This report describes an investigation into the modelling approximations normally made when the LWR lattice code LWRWIMS is used for design calculations on assemblies containing burnable poison pins. An estimate is made of the effect of using pin-cell smearing with diffusion theory for the assembly geometry, instead of a more exact heterogeneous transport theory calculation. The influence on reactivity of the minor gadolinium isotopes 152, 154, 156, 158 and 160 in a poison pin dominated by the isotopes 155 and 157 is presented, and finally, recommendations on the use of LWRWIMS for this type of calculation are made.

11949 **(AERE-M—3300) BUCKL: a computer program to read and process fluxes from the WIMS-E module WSNAP.** Needham, J. (UKAEA Atomic Energy Research Establishment, Harwell. Materials Physics Div.). Feb 1983. 4p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704338.

A computer program (BUCKL) which will read the sequential geometry file and the fluxes written to a direct access file by the WSNAP module in the WIMS-E scheme is introduced. The user will obtain a map showing the material number at each mesh point in the model. Various options are also available which provide for the production of a table of mesh volumes, a flux map for each requested energy group, and buckling estimates at each point in axial and/or radial directions with their sum if required. In addition, corresponding volume weighted bucklings may be averaged over a given block of meshes.

11950 **(CEA-CONF—6818) Neutron transport calculations.** Reuss, P. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Sep 1983. 8p. (In French). (CONF-8309186—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750468.

From 49. meeting of the Frence working group on dosimetry; Grenoble, France (21 Sep 1983).

The basic principle of neutronic calculations is reviewed. The APOLLO code is presented; its qualification and its validation are discussed.

11951 **(CEA-N—2358) Theoretical study of some nodal methods for the solution of the diffusion equation. Numerical tests.** Fedon-Magnaud, C. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Aug 1983. 102p. (In French). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84750470.

The nodal methods used in the solution of the neutron multigroup diffusion equation are described. A new formulation of this methods is obtained in order to have a comparison with the finite element methods. After a brief review of nonconforming finite element theory, we use a Radau formula to establish the equivalence with nodal schemes. Convergence theorems and error estimations are then obtained. In the last part, numerical calculations are performed for two reactor test configurations. Comparisons are done between nodal or nonconforming schemes and more classical methods (F.D., conforming F.E.) wich are used in reactor analysis.

11952 **(CNEN-RT/FI—81-20) TOCAR: a code to interface FOURACES - CARNAVAL.** Panini, G.C.; Vaccari, M. (Comitato Nazionale per l'Energia Nucleare, Bologna (Italy). Dipartimento Ricerca Tecnologica di Base ed Avanzata). Aug 1981. 42p. (In French). NTIS (US Sales Only), PC A03. Order Number DE82903062.

Paper copy only, copy does not permit microfiche production.

The TOCAR code, written in FORTRAN-IV for IBM-370 computers, is an interface between the output of the FOURACES code and the CARNAVAL binary format for the multigroup neutron cross-sections, scattering matrices and related quantities. Besides the description of the code and the how to use, the report contains the code listing.

11953 **(CTH-RF—42) Benchmark calculations on simple reactor systems.** Sjoestrand, N.G. (Chalmers Tekniska Hoegskola, Goeteborg (Sweden). Institutionen foer Reaktorfysik). Dec 1982. 8p. (CONF-830151—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704339.

From Conference on status of static reactor calculations in Nordic countries; Goeteborg, Sweden (18 Jan 1983).

The development of some calculation methods is described. Tests of these and other methods on benchmark problems are reported. The following items are treated: 1) Criticality of spheres and slabs for monoenergetic neutrons with Carlviks method. 2) High precision S sub (n) calculations on critical slabs. 3) Comparison of angular quadrature methods in S sub (n) calculations. 4) Tests of a standard ANISN program. 5) Presence of complex time eigenvalues in a fundamental problem.

11954 **(CTH-RF—44) Summary of the meeting statns of static reactor calculations in Nordic countries.** Lindahl, S.-Oe. (Chalmers Tekniska Hoegskola, Goeteborg (Sweden). Institutionen foer Reaktorfysik). Feb 1983. 8p. (CONF-830151—Summ.). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704340.

From Conference on status of static reactor calculations in Nordic countries; Goeteborg, Sweden (18 Jan 1983).

Some impressions of the material presented at the meeting are given. The covered areas were as follows: in-core fuel management, cross section generation, burnable absorbers nodal models, pin power calculations and benchmarking.

11955 **(FEI—1343) Program for neutron-physical calculation of a nuclear reactor over lifetime. RFZT program.** Aleksandrova, Eh.M.; Zemskov, E.A.; Isakova, L.Ya.; Rachkova, D.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1982. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704341.

Program for calculating the burnup processes in a nuclear reactor using the few-group approximation for the (r, y, z)-geometry is described. The problem formulation is considered. The calculation algorithm flowsheet is given. The calculation technique is based on the concept of few-group microsection fitting according to a number of the most important functionals which are obtained as a result of the burnup calculation in the multigroup approximation for one-dimensional geometry. To solve the equations of fuel concentration change, fission fragment, samarium and xenon accumulation and burnable poison burnup, the Euler simple one-step method is used. The program is written in FORTRAN and adapted for the BESM-6 computer. Program parameters are the following: the number of energy group $<= 4$, the number of radial zones $<= 10$, the number of axial zones $<= 10$, the number of absorbing rods per an element of asymmetry $<= 30$, symmetry coefficient $<= 12$. The number of time steps into which the reactor lifetime acan be divided, is arbitrary. Time for calculation of a reactor with 9 radial zones, 7 axial zones and 30 absorbing rods is about 30 min.

11956 **(FRNC-TH—1114) Various types of numerical schema for the one-dimensional spherical geometry transport equation.** Jaber, A. (Besancon Univ., 25 (France)). Jul 1981. 102p. (In French). NTIS (US Sales Only), PC A06/MF A01. Order Number DE83704236.

Mathematical and numerical studies of new schemas possessing high accuracy spatial variable properties are described and the corresponding studies presented. In order to do this, the [0,R] x [-1,+1] rectangle is decomposad into Ksub(ij) = [rsub(i),rsub(i+1)] x [μsub(j),μsub(j+1)] rectangles. Continuous finite element methods employing polynominals of degree 1 in μ and degree 2 in r are defined for each elements. In chapter I, different ways of rendering the particular equation (for μ = -1) discrete are studied. In chapter II, numerical schemas are described and their stability investigated.

In chapter III, error estimation theories are exposed and numerical results for different second members, S, given.

11957 (IAE—3576/5) Technique for calculating the frequency characteristics and analysis of the stability of the tank type boiling water cooled reactors with natural circulation. Leppik, P.A.; Plyutinskij, V.I.; Pavlov, S.P. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1982. 22p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703890.

A technique is described for calculation of frequency characteristics and analysis of tank type boiling water cooled and moderated reactors with natural circulation. The RUKKRETZ-1 computer code on the base of this technique is created. The reactor stability is computed in a linear approximation. The reactor kinetics is described by a one-speed diffusion equation taking into account one basic mode of the neutron flux. Nonidentity of working conditions for steam generating channels regarding power, coolant flow rate and fuel is accounted for by way of subdivision of the steam generating channels into N groups (N <= 15). The performances of the channels for each group are considered to be equal. The final result of calculations is determining the reactor complex frequency characteristics. The reactor stability relative to the interchannel hydraulic and general circuit hydro-neutronic pulsations is estimated on the base of the reactor frequency characteristics with the use of the Nyquist criterion or argument principle.

2202 Components And Accessories

REFER ALSO TO CITATION(S) 12067, 12377

11958 (AD-P—001743/4) Use of steel fiber reinforced concrete in containment and explosive-resistant structures. Henager, C.H. (Battelle Pacific Northwest Labs., Richland, WA (USA)). May 1983. 5p. NTIS, PC A02/MF A01.

The results of several investigations of steel fiber reinforced concrete (SFRC) under explosive loading are presented. Tests using high explosives were performed by the U.S. Corps of Engineers to compare reinforced concrete slabs using conventional concrete to similar slabs using SFRC. The conventional slabs containing SFRC retained their integrity even though severely damaged. Similar results were obtained with explosive tests on slabs by Lawrence Livermore Laboratory, impact loading by a pendulum-type impact machine, ballistic impact by small arms fire, impulsive loading on beams and a drop weight impact test. Use of SFRC in a reactor containment structure is reviewed. Design aids and potential applications of SFRC for blast resistance in structures are listed.

11959 (AECL—6829) Computer-aided surface roughness measurement system. Hughes, F.J.; Schankula, M.H. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). Nov 1983. 44p. Atomic Energy of Canada Ltd., Scientific Document Dist. Office, Chalk River, Ontario, Canada KOJ 1JO $4.00.

Work performed under Canada/US Waste Management Exchange Agreement.

A diamond stylus profilometer with computer-based data acquisition/analysis system is being used to characterize surfaces of reactor components and materials, and to examine the effects of surface topography on thermal contact conductance. The current system is described; measurement problems and system development are discussed in general terms and possible future improvements are outlined.

11960 (AECL—6829) Computer-aided surface roughness measurement system. Hughes, F.J.; Schankula, M.H. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). Nov 1983. 44p. Atomic Energy of Canada Ltd., Scientific Document Dist. Office, Chalk River, Ontario, Canada KOJ 1JO $4.00.

Work performed under the Canada/US Waste Management Information Exchange Agreement.

A diamond stylus profilometer with computer-based data acquisition/analysis system is being used to characterize surfaces of reactor components and materials, and to examine the effects of surface topography on thermal contact conductance. The current system is described; measurement problems and system development are discussed in general terms and possible future improvements are outlined.

11961 (INIS-mf—8557, pp 199-205) Contribution to assessment of pressure vessel life at variable load amplitude. Vlk, M.; Vejvoda, S. (Vitkovice, o.p. - Ustav Aplikovane Mechaniky, Brno (Czechoslovakia)). [nd]. (In Czech). NTIS (US Sales Only), PC A03/MF A01. (CONF-8010336—Vol.2).

From National ICF conference on structure damage processes and fault diagnostics; Srni, Czechoslovakia (13 Oct 1980).

The methods are compared of the determination of the service life of pressure vessels at variable load amplitude according to the Soviet standard and to the HOROTE programme for the HP 9845 minicomputer. This programme better depicts the history of stress deformation conditions than does the said standard.

11962 (PB—83-263517) Toshiba review. Volume 38, Number 7, 1983. (Toshibe Corp., Tokyo (Japan). Principal Office). 1983. 84p. NTIS, PC E05/MF E01.

Contents: Preface to special issue on new media; Direct-broadcasting satellite receiver CATV system; Addressable CATV system; Multipurpose CATV system; Voiced and handwritten signal communication equipment; Digital high performance captain adapter; Teletext receiver; Ghost clean system; Projection display for high-definition TV; Control rod drive mechanism for fast breeder reactor; Spacer for LMFBR's fuel assembly; Evaluation of natural circulation in fast reactor, JOYO; Toshiba advanced reactor management system, TARMS; Computerized radiological protection and management system for nuclear power plant; High-power infrared GaAIAs LED, TLN 202; Design improvement of 26-inch last-stage blade for steam turbine; Application of digital control system to large-scale thermal power plants.

11963 (PB—83-264788) Mitsubishi technical review. Volume 20, Number 2. Series Number 57, 1983. (Mitsubishi Heavy Industries Ltd., Tokyo (Japan)). Jun 1983. 106p. NTIS, PC E06/MF E01.

Contents: Features of Current PWR Power Plant (General Review); Development of a Plant Operation Guidance System; Total Radioactive Solid Waste Processing System; Recent Technology Trend in PWR Turbine Plant; Remote Operation and Automation of the Maintenance Works under the Radiation Field (illustration); Development of Arc-Welding Robot for Nozzle of Boiler Drum; Field Study on Mechanical Strength of Sea Ice at East Coast of Hokkaido; A Study of Elementary Control Techniques for Car Air Conditioner; Radioactive Solid Waste Storage System; Completion of Coal-fired Marine Boiler; Mitsubishi Hydraulic Loading Shovel MS580; Mitsubishi Dry Type Mechanical Screen (Rack Type); Mitsubishi L300 '83 Year Model; 1983 Year Model Mitsubishi CANTER 1.5-3.5 Tonner Trucks; Large Sized Touring Coach, MS7 Series; Oceanographic Research Vessel 'TANSEI MARU';Mitsubishi Dredging Assist System for Cutter Suction Dredger 'MIDAS-C';Mitsubishi Testing Plant of Biaxially Oriented Film Production; Refreshing Breeze in All Seasons with Mitsubishi Daiya Ceiling Recessed Packaged Type Heat Pump Air Conditioner.

11964 (ZJE—256) Heat transfer in circular ring channel under reflooding conditions. Blaha, V.; Nikonov, S.P. (Skoda, Plzen (Czechoslovakia). Zavod Vystavba Jadernych Elektraren). 1981. 54p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE83703909.

The method and equipment are described for flooding experiments in a ring-shaped channel with an unheated external wall. The values measured during the experiment are tube wall temperature, the power input of the heating rod, the temperature of the flooding medium, the flow, the temperature of the envelope, pressure gradient in the measured section, pressure in the storage tank and temperature in the upper chamber. The dependence is shown of the coefficient of heat transfer on the temperature gradient be-

tween the wall and the medium which may be degasified water, CO_2 saturated water, or N_2 saturated water.

2203 Fuel Elements

REFER ALSO TO CITATION(S) 12076

11965 **(SAAS—306) Model investigations of the heat transfer from spent fuel assemblies in gas-filled shipping casks.** Nitsche, F. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). 1983. 30p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83704348.

In the transportation of spent fuel assemblies (FAs) special attention has to be focussed on the safe dissipation of radioactive decay heat to the environment in order to avoid impermissible temperatures developing at the shipping cask or the FAs. Because the corresponding safety parameters, that is, the maximum FA and fuel element surface temperatures, cannot, however, be measured directly within the casks, model experiments have been performed in which the 30 WWER-type FAs contained in one shipping cask were simulated by 30 electrically heated rods at a scale of 1:8. The same scale of reduction was used for dimensioning the inner volume of the model cask. The results obtained enable a better qualitative insight into the mechanisms of heat transfer within the shipping cask, including a more precise interpretation of measurable internal temperatures and provide a quantitative description of the radiant heat transfer process. The results can also be applied to 'dry' storage and handling of spent FAs.

11966 **Predicted and observed scatter in the fuel rod temperature of replicate rods during irradiation.** Cunningham, M.E.; Lanning, D.D. (Pacific Northwest Laboratory, P.O. Box 999, Richland, Washington 99352). *Nuclear Technology;* 60: No. 3, 420-429(Mar 1983).

Irradiation data collected from test fuel rods that were identically built and operated may be used to define a range of normal performance for a specific fuel rod design. By comparing the data to computer code calculations, it is possible to define the range of applicability of fuel thermal performance computer codes. Data scatter for the centerline temperature from identical rods in several test assemblies decreases from the first power ascension to the third power ascension. Calculated uncertainty bands for the data (i.e., expected variability for the data assuming dimensional tolerances, material property uncertainties, and power uncertainties) are found to be larger than the data scatter. The FRAPCON-2 temperature calculations agree with temperature data from helium-filled rods; however, the code does not match beginning-of-life temperatures from a xenon-filled rod. However, the code results agreed with data obtained from the xenon filled rod at higher burnup, thus indicating that the code adequately calculates fuel temperatures for fission gas-filled rods later in life.

11967 **Dispersed flow film boiling heat transfer data near spacer grids in a rod bundle.** Yoder, G.L.; Morris, D.G.; Mullins, C.B.; Ott, L.J. (Oak Ridge National Laboratory, Bldg. 9204-1, MS-7 P.O. Box Y, Oak Ridge, Tennessee 37830). *Nuclear Technology;* 60: No. 2, 304-313(Feb 1983).

A series of steady-state film boiling experiments have been conducted to show the effect of spacer grids on rod bundle heat transfer. Experiments were performed at the Oak Ridge National Laboratory in the Thermal-Hydraulic Test Facility, a pressurized water loop containing a 64-rod bundle, of which 60 rods are electrically heated. The bundle is equipped with detailed thermometry around two grids, which allows grid heat transfer effects to be studied. Rod surface temperature data show a 75 to 150 K temperature difference between measurements upstream and downstream of the grids, while heat transfer coefficients increase across the grids by 20%. Twenty to thirty hydraulic diameters are required for these effects to dissipate.

2204 Control Systems

REFER ALSO TO CITATION(S) 12688, 12689

11968 **(CEA-CONF—6653) Computation of a crack-free absorber material.** Aji, M.; Ballagny, A. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Apr 1983. 22p. (CONF-8304124—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704344.

From Specialist meeting on absorbing pins and materials; San Francisco, CA, USA (11 Apr 1983).

From a computation of the thermal stress field as a function of most important parameters (pin diameter, boron carbide grain size, pellet density) a design emerges in which pellets do not crack under irradiation, avoiding fragment wedging. Rod tube inner diameter and ^{10}B content per unit length being specified, as data of the problem, the calculations are performed in two steps: selection of geometry (number of pins and pin diameter), and determination of density and grain size after geometry has been selected.

11969 **(CEA-CONF—6656) Behaviour of absorbing elements pins irradiated in Phenix.** Colin, M.; Kryger, B. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Apr 1983. 19p. (CONF-8304124—3). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704346.

From Specialist meeting on absorbing pins and materials; San Francisco, CA, USA (11 Apr 1983).

This paper is concerned with P.I.E. (post-irradiation examinations) results of absorbing pins issued from control covering the burn-up range 40-120 x 10^{20} captures/cm^3; it deals principally with dimensional changes, boron-carbide swelling and He-release.

11970 **(CEA-CONF—6658) Carburization of absorbing element cladding in fast breeder reactors.** Cytermann, R.; Sagot, J.P.; Rouault, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Apr 1983. 40p. (CONF-8304124—4). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83704347.

From Specialist meeting on absorbing pins and materials; San Francisco, CA, USA (11 Apr 1983).

The phenomena of carburization in the cladding of absorbing elements in fast breeder reactors was studied by the techniques of X-ray microanalysis and micro-hardness. A comparison of the results obtained for different types of pins showed that the intensity and depth of the carburization were closely dependent on the amount of free carbon present in the boron carbide. An assessment was made of the effects of the stresses produced within the cladding. Mechanical properties were in general little affected; however, in the case of the most severely carburized pin a distinct loss of ductility was observed.

11971 **(CEA-CONF—6840) Effect of earth-connection of the cable-ways on electromagnetic compatibility of low level links in nuclear power stations.** Buisson, J.; Lecompte, J.C. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Jun 1983. 6p. (In French). (CONF-830638—2). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750434.

From 2. national colloquium on electromagnetic compatibility; Tregastel, France (1 Jun 1983).

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The detector on measurement lines used in nuclear powerstations is located many hundred meters far from electronic device in adverse surroundings (electromagnetic rays and temperature) so a preamplifier can't be used. Low amplitude impulses up to 10 E - 13 coulomb, are carried along with rise times in the range of 10 to 20 ns. Cable-ways play an important part in the link sensitivity to radioelectric disturbances. In fact, cables and cable-ways are similar to transmission lines as for disturbance currents that are directly affected by cable-way impedance. The following steps have been proceeded: disturbance current distribution measurements in situ in cable-ways with several earth-connection configurations; equivalent

mathematic pattern studies; applied mathematic patterns to plant. The best protection from radioelectric disturbances has been found for a cable-way earth-connection configuration.

11972 **(FRNC-TH—1104) Contribution to the qualification of a calculation schema for PWR reactors involving Gd and Hf neutron absorbers.** Therond, P. (Paris-11 Univ., 91 - Orsay (France)). Jun 1982. 165p. (In French). NTIS (US Sales Only), PC A08/MF A01. Order Number DE83704240.

Hafnium is a material currently used to control plate reactors. It is therefore important to know the degree of accuracy with which its efficiency can be calculated. For reasons, which have little to do with neutronics, it has recently been envisaged to replace this type of control with gadolinium poisons. The interpretation of criticality experiments is the means adopted to qualify these absorbant heterogeneity calculations. Two types of experiment are performed: - For plate lattices, several programs specially developed to test the calculations performed are available; these calculations begin by considering very simple one-dimensional calculations and gradually develop towards realistic two - and three - dimensional configurations. We have interpreted tests of this type realized up until the present day in the framework of such considerations. - In order to complete information obtained in this way, data from experiments performed on a 17 x 17 PWR rod lattice containing the same type of absorbers have been exploited in parallel with these experiments. It has been possible, because of the diversity of the configurations studied, to test most of the codes and calculation options currently used by the CEA for the early life of water reactor lattices, containing hafnium and godolinium absorbant heterogeneities.

11973 **(NUREG/CR—3557) CRT display evaluation: the checklist evaluation of CRT-generated displays.** Blackman, H.S.; Gertman, D.I.; Gilmore, W.E. (EG and G Idaho, Inc., Idaho Falls (USA)). Dec 1983. Contract AC07-76ID01570. 37p. (EGG—2285). NTIS, PC A03/MF A01. Order Number DE84004664.

This report, the third in a series evaluating various methods for determining the effectiveness of display formats, contains the description, development, and testing of a checklist instrument on four formatted displays. This work supports the United States Nuclear Regulatory Commission's effort to develop valid and reliable techniques for the evaluation of computer generated displays currently being implemented in nuclear power plant control rooms. Certified Operators at a DOE Research Reactor used the checklist to evaluate four formats - BARS, STARS, METERS, and pressure temperature map (P-T map). A weighting scheme was developed using nine judges and an equal appearing interval technique. Four empirical factors were identified: display characteristics, information content, information format, and information quality. Tests of significance were run between display formats for BAR, STAR, and METER, as well as data collected in a second experiment between the display formats BAR and P-T map. Validity and reliability coefficients were calculated and presented. The results demonstrate the checklist to be a reliable and valid instrument for a display evaluation effort.

11974 **(PB—83-247650) Assessment of control rooms of nuclear power plants.** Norros, L.; Ranta, J.; Wahlstroem, B. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). [nd]. 34p. NTIS, PC E04/MF E01.

To identify and correct the lacks in control rooms of operating power plants and plants under construction an extensive program has been started in the USA. In Finland as in other countries using nuclear power, the development in the USA particularly with regard to the requirements imposed on nuclear power plants is carefully followed. The changes in these requirements are sooner or later also reflected in the guidelines given by the Finnish authorities. It is therefore important to be able to form a notion of how the new requirements apply to Finnish conditions. Especially it is important to review the latest assessment guidelines for control room implementation (NUREG-0700). Thus we can avoid possible over hasty conclusions. (Copyright (c) Valtion teknillinen tutkimuskeskus (VTT) 1983.)

11975 **Fission control system for nuclear reactor.** Conley, G.H.; Estes, G.P. US Patent Application 6-446,814. [nd]. 16p. Contract AC11-76PN00014.

Control system for nuclear reactor comprises a first set of reactivity modifying rods fixed in a reactor core with their upper ends stepped in height across the core, and a second set of reactivity modifying rods movable vertically within the reactor core and having their lower ends stepped to correspond with the stepped arrangement of the first set of rods, pairs of the rods of the first and second sets being in coaxial alignment.

11976 **Linear motion device and method for inserting and withdrawing control rods.** Smith, J.E. US Patent Application 6-447,850. [nd]. 21p. Contract AC11-76PN00014.

Disclosed is a linear motion device and more specifically a control rod drive mechanism (CRDM) for inserting and withdrawing control rods into a reactor core. The CRDM and method disclosed is capable of independently and sequentially positioning two sets of control rods with a single motor stator and rotor. The CRDM disclosed can control more than one control rod lead screw without incurring a substantial increase in the size of the mechanism.

2205 Environmental Aspects

REFER ALSO TO CITATION(S) 12015, 12820

11977 **(EGG-MS—6411) Iodine adsorbent poisoning - FY-83 report.** Jolley, J.G.; Tompkins, H.G. (EG and G Idaho, Inc., Idaho Falls (USA)). Sep 1983. Contract AC07-76ID01570. 31p. NTIS, PC A03/MF A01. Order Number DE84005464.

Silver zeolite was exposed to various organics at ambient temperature to measure their effect on the silver zeolite's ability to subsequently adsorb iodine and to desorb the organics at elevated temperatures. The organics examined were alkanes, alkynes, aromatics, ketones, alcohols, and halocarbons (methyl and ethyl based). The reduction in iodine removal efficiency ranged from zero to 96%. Adding additional radicals to the base organic generally had the effect of decreasing the silver zeolite's iodine removal efficiency. During desorption, the concentration of the organic remaining in the silver zeolite versus time was monitored by FT-IR, EDS, and XPS. Halogen desorption was negligible at 300°C for three weeks; the data for the non-halogenated organics were fit to rate equations. From these rate equations, Arrhenius activation energies, ranging from 4 to 30 kcal/mol, and A factors, ranging from 4×10^{-1} to 2×10^{10} s^{-1}, were determined.

11978 (IAEA-SR—72, pp 248-265) **In-situ control of the iodine traps in France.** Mulcey, P.; Trehen, L. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Inst. de Protection et de Surete Nucleaire, Dept. de Protection, Service de Protection Technique); Rouyer, J.L. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Inst. de Protection et de Surete Nucleaire). May 1983. (In French). NTIS (US Sales Only), PC A99/MF A01. (CONF-8205206—; IAEA-SR—72/11).

From Seminar on the testing and operation of off-gas cleaning systems at nuclear facilities; Karlsruch, F.R. Germany (3 May 1982).

The in-situ regulatory control of the iodine traps cleaning is performed in France following a method developed 10 years ago and recently standardized. In the first part experience is described with such a method, both with research reactors (CEA, COGEMA, etc.) as well as with nuclear power plants (EDF). In the second part, the method is briefly presented as well as the tests and the quality controls performed on activated carbon before being placed within the cleaning filters. In the last part an analysis of the results is presented - in particular, the influence of the leakage rate of the installations, the humidity of the radioactive effluents treated and the aging of the iodine traps are discussed. In conclusion, a set of recommendations following the experience gained is given.

11979 (IAEA-SR—72, pp 500-509) **Standardization of radioactive gaseous waste radiation monitoring equipment from the International Electrotechnical Commission.** Fitoussi, L. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Inst. de Protection et de Surete Nucleaire); Gaulard, R. (Commission Electrotechnique Internationale, Clamart (France)). May 1983. (In French). NTIS (US Sales Only), PC A99/MF A01. (CONF-8205206—; IAEA-SR—72/9).

From Seminar on the testing and operation of off-gas cleaning systems at nuclear facilities; Karlsruch, F.R. Germany (3 May 1982).

After having introduced the works performed by the International Electrotechnical Commission, the authors report on the results of the studies carried out to achieve the standardization of the radiation monitoring equipment concerning the control of the gaseous waste from nuclear installations. The authors present the most interesting aspects of the regulations and recommendations, which include not only a description of the minimum permissible levels of sensitivity for the monitors, but also a description of the set of assays to be established in order to verify the level of performance of the monitors.

11980 (NUREG/CR—3476) **Chemicals in effluent waters from nuclear power stations: the distribution, fate, and effects of copper.** Harrison, F.L. (Lawrence Livermore National Lab., CA (USA)). Sep 1983. Contract W-7405-ENG-48. 59p. (UCRL—53486). NTIS, PC A04/MF A01 - GPO. Order Number DE84005434.

This report provides a summary of research performed to determine the physicochemical forms and fate of copper in effluents from power stations adjacent to aquatic ecosystems with water that differs in salinity, pH, and concentrations of organic and inorganic constituents. In addition, research performed to evaluate responses of selected ecologically and economically important marine and freshwater organisms to increased concentrations of soluble copper is reviewed. The same parameters were measured and the same analytical techniques were used throughout the study. Copper concentration and speciation, in influent and effluent waters collected from eight power stations using copper alloys in their cooling systems, showed that the quantities of copper associated with particles, colloids, and organic and inorganic ligands differed with the site, season, and mode of operation of the station. Results are presented.

2206 Research, Test, And Experimental Reactors

REFER ALSO TO CITATION(S) 12019, 12056

11981 (DOE/ER/04014—13) **University of Florida training reactor. Annual progress report, September 1, 1982-August 31, 1983.** Diaz, N.J.; Vernetson, W.G. (Florida Univ., Gainesville (USA). Dept. of Nuclear Engineering Sciences). Nov 1983. Contract AC05-76ER04014. 31p. (ORO—4014-13). NTIS, PC A03/MF A01. Order Number DE84005142.

Reported are: facility operation, modifications, maintenance and tests, changes to technical specifications and standard operating procedures, radioactive releases and environmental surveillance, and utilization. (DLC)

11982 (DOE/SF/11687—T1) **Technological implications of SNAP reactor power system development on future space nuclear power systems.** Anderson, R.V. (Rockwell International Corp., Canoga Park, CA (USA). Energy Systems Group). 16 Nov 1982. Contract AT03-82SF11687. 39p. NTIS, PC A03/MF A01. Order Number DE83016162.

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Nuclear reactor systems are one method of satisfying space mission power needs. The development of such systems must proceed on a path consistent with mission needs and schedules. This path, or technology roadmap, starts from the power system technology data base available today. Much of this data base was established during the 1960s and early 1970s, when government and industry developed space nuclear reactor systems for steady-state power and propulsion. One of the largest development programs was the Systems for Nuclear Auxiliary Power (SNAP) Program. By the early 1970s, a technology base had evolved from this program at the system, subsystem, and component levels. There are many implications of this technology base on future reactor power systems. A review of this base highlights the need for performing a power system technology and mission overview study. Such a study is currently being performed by Rockwell's Energy Systems Group for the Department of Energy and will assess power system capabilities versus mission needs, considering development, schedule, and cost implications. The end product of the study will be a technology roadmap to guide reactor power system development.

11983 (HEDL-SA—2952-FP) **Performance of the FFTF heat transport system during cycles 1 and 2.** Burke, T.M.; Yunker, W.H.; Cramer, E.R. (Hanford Engineering Development Lab., Richland, WA (USA)). 31 May 1983. Contract AC06-76FF02170. 6p. (CONF-831047—125). NTIS, PC A02/MF A01. Order Number DE84004826.

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

From April 1982 through May 1983, the Fast Flux Test Facility (FFTF) completed its first two full cycles of operation. This experience has provided significant information relative to the performance of the Main Heat Transport System (MHTS). While in general, the MHTS performance has been extremely good, there have been a few unanticipated events and trends which could very well influence the design and/or operation of further LMFBR plants. The performance of the major MHTS components is discussed.

11984 (ORNL/TM—8970) **Oak Ridge research reactor. Quarterly report, April, May, and June 1983.** Corbett, B.L.; Lance, E.D. (Oak Ridge National Lab., TN (USA)). Jan 1984. Contract W-7405-ENG-26. 32p. NTIS, PC A03/MF A01. Order Number DE84005082.

The ORR operated at an average power level of 29.4 MW for 92.1% of the time during this period. The reactor was shut down on twelve occasions, five of which were unscheduled. Reactor downtime needed for refueling and checks was normal. The reactor remained available for operation 97.9% of the time. Maintenance activities, both mechanical and instrument, were essentially routine in nature with the exception of one Instrumentation and Controls Change memorandum.

11985 (ZJE—260) **SKODA in-core calorimeters.** Jirousek, V. (Skoda, Plzen (Czechoslovakia). Zavod Vystavba Jadernych Elektraren). 1982. 17p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703910.

A miniature in core calorimeter is described developed for measuring fission heat distribution and neutron flux density. The techniques of loading the sensor in the core, calibration, testing experiments and the results of measurements on the WWR-S experimental reactor are presented.

2207 Plutonium And Isotope Production Reactors

REFER ALSO TO CITATION(S) 11663, 12022

11986 (DOE/SR/00001—T15) **Deionizer resin specifications for chloride.** Longtin, F.B. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). 31 Aug 1972. Contract AC09-76SR00001. 3p. NTIS, PC A02/MF A01. Order Number DE84005575.

The intent of the specification is to limit the amount of chloride ion which can enter the reactor moderator to cause chloride corrosion cracking of stainless steel. The safe upper limit is somewhere below 1000 ppB and is arbitrarily assumed to be about 100 ppB. Under the existing resin specification the moderator chloride concentration ranges from 0.5 to 50 ppB with a median value of about 5 ppB; corrosion experience has been satisfactory on the whole under these conditions. Through most of this period a method of analyzing and reporting chloride content of resin has been used which accepted values up to 0.0149 meq/ml; a recent

change in method of reporting rejects values greater than 0.100 meq/ml.

11987 **(DOE/SR/00001—T16) Series operation of deionizers (TA 1-1644).** Longtin, F.B. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). 23 Oct 1968. Contract AC09-76SR00001. 7p. NTIS, PC A02. Order Number DE84005586.

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A test was performed in L Area (June 1967) to determine if loss of mixed bed deionizer life from radiation damage could be reduced by operating a cation bed ahead of the mixed bed deionizer. The cation deionizer removed about 95% of the radioactivity coming to it from the reactor. However, it caused premature conductivity breakthrough of the mixed bed because of sloughage of ionic fragments from the cation resin. Similar shortening of the anion resin life by series operation of separate cation and anion beds has been observed elsewhere in nonradioactive service.

11988 **(DOE/SR/00001—T17) High flow vs TRE.** Longtin, F.B. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). 11 Jul 1966. Contract AC09-76SR00001. 8p. NTIS, PC A02. Order Number DE84005570.

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Increased purification flow is effective only in controlling high ionic radioactivity and its consequences. The possible gains are greatly limited by the presence of fixed long-lived radioactivity in piping. Most of the realizable gains from high flow have already been achieved at 150 gpm flow. The turbidity removal evaporator (TRE) is effective mainly in reducing turbidity and associated mechanical problems. Turbidity is now normally low. There is some risk of high turbidity in long (Mark VI-E) cycles, but it cannot be clearly estimated. Where high turbidity occurs, a major (ie. sevenfold) reduction in its concentration and consequences can be achieved by installing a TRE.

11989 **(DOE/SR/00001—T18) Mixed bed deionizers for moderator purification.** Flannagan, G.N. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). 10 Jan 1963. Contract AC09-76SR00001. 16p. NTIS, PC A02/MF A01. Order Number DE84005680.

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Charts are presented for: problems resulting from use of cation resin beds, purification resin beds, resin bed experience, nitrates in moderator, moderator chlorides, release of ^{35}S to effluent streams, disassembly basin releases of radioactivity to effluent streams, sulfur in the reactor system, recommendations, deionizer costs, and studies program. (DLC)

11990 **(DOE/SR/00001—T19) Anion resin particle size.** (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). 24 Aug 1966. Contract AC09-76SR00001. 16p. NTIS, PC A02. Order Number DE84005587.

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The L Area 1964 incident is the only case of trouble ascribed to presence of resin in the moderator. No other trouble occurred in 13 years of operation using either a) resin purchased without any size specification; b) resin purchased without on-plant verification of particle size or c) resin not meeting EMS 63 specifications.

11991 **(DOE/SR/00001—T20) Organics in moderator by permanganate demand analysis.** Jacobsen, W.R. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). 30 Apr 1964. Contract AC09-76SR00001. 8p. NTIS, PC A02. Order Number DE84005581.

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If the organic material indicated in L area is anion resin, degraded by radiation to monomeric forms, about 3 to 4 pounds (dry) of this resin uniformly distributed in the moderator would explain both the low peroxide values and the permanganate demand results. The limitations on this assumption and what the permanganate analyses mean in terms of other compounds are presented in the Discussion section. The extent of oxidation of many organic materials in the permanganate demand procedure is not known. Predicted reactions are included in the Discussion section of this report, and calculations are base on these assumed reactions. Under the conditions of the procedure for determining permanganate demand, peroxide reacts quantitatively with permanganate. Since peroxide is determined by another method, a correction can be applied for this reaction. In cases where the permanganate demand is nearly all accounted for by peroxide, the sensitivity of the method for organic determinations is limited. Recent analytical data shows 0.5 to 1.5×10^{-5} gm $KMnO_4$/ml moderator in L, K and R areas. However, in L area peroxide accounts for less than ten percent of the permanganate demand, while in R and K areas the comparable value is 75 to 100% (see Table I in Discussion).

11992 **(DOE/SR/00001—T21) Moderator degradation - 1964.** Bertsche, E.C.; Berry, J.T. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). [nd]. Contract AC09-76SR00001. 5p. NTIS, PC A02. Order Number DE84005443.

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The moderator degradation data have been analyzed to determine the cause for degradation occurring in the calendar year 1964. This breakdown for each source is shown along with moderator degradation data reported in RTR-602 for calendar year 1963. Degradation in 1964 was the highest experienced to date. It increased by 148% over 1963, with the principal increase in the categories of heat exchanger leaks and drains, evaporator condensate tank material, and miscellaneous valve and flange leaks.

11993 **(DOE/SR/00001—T22) Mixed bed deionizers - all 100 areas.** Flannagan, G.N. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). 7 Nov 1962. Contract AC09-76SR00001. 5p. NTIS, PC A02. Order Number DE84005591.

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The use of cation resin beds to facilitate control of moderator pD has resulted in several undesirable phenomena which should be corrected. One of these phenomena is the presence and buildup of anions other than nitrate in the moderator. This risk was recognized earlier, however sufficient information to demonstrate the undesirability of using cation resin beds, rather than mixed beds, was not developed until recently. This memorandum discusses the undesirable effects of using cation resin beds, rather than mixed beds, and provides a recommendation for discontinuing the use of cation resin beds in all 100 areas.

11994 **(DPSP—56-25-35) Optimum purification flow.** Nicholson, W.J. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). 4 Dec 1956. Contract AC09-76SR00001. 32p. NTIS, PC A03/MF A01. Order Number DE84005574.

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The R Area Purification system was operated at several flow rates between 2 and 90 gpm to determine the effect of flow rate on moderator purity. Flow rates of 10 to 30 gpm were found to produce the desired low values of activity, conductivity and deuterium evolution. Activity level, rate of D_2O decomposition, and corrosion rates increase when ionic impurities are present in the reactor moderator. A moderator flow rate of 30 gpm through the deionizers and filters was prescribed prior to initial reactor startup as the estimated optimum flow to remove the expected large amount of impurities and to permit a daily turnover of moderate through Purification. After the actual impurity generation rate was found to be smaller than expected, tests in P Area (Ref 1) showed that the generation of ionic impurities might possibly be decreased by operating the purification equipment at reduced moderator flow rates.

11995 **(DPSP—64-1-1) Moderator chemistry: moderator pD control during L-2.** (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). [nd]. Contract AC09-76SR00001. 3p. NTIS, PC A02/MF A01. Order Number DE84003743.

Moderator pD control during the L-2 cycle and radioactivity during L:1-2 are reported. (DLC)

11996 **(DPSP—64-1-3) Moderator chemistry: moderator pD control, L-2 cycle.** (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). [nd]. Contract AC09-76SR00001. 4p. NTIS, PC A02/MF A01. Order Number DE84005576.

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Moderator pD control during the L-2 cycle and corrosion of type X8001 aluminium (Mark VI-B fuel clad) are reported. (DLC)

11997 **(DPST—60-228) Exhausted deionizers as a source of chloride in moderator.** Baumann, E.W. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 22 Mar 1960. Contract AC09-76SR00001. 9p. NTIS MF A01. Order Number DE84005573.

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Operation of a deionizer containing exhausted anion resin, where the principal anionic constituent of the influent is NO_3^-, will result in elution of the other anions from the column. In the moderator system, where the exhausted anion resin contains principally HCO_3^-, Cl^-, and NO_3^-, most of the HCO_3^- will be eluted before much of the Cl^- is released. This can be observed in the conductivity record of the effluent, for the conductivity will level off as H_2CO_3 is released, and rise with the release of the stronger acid, HCl. This behavior was observed in the miniature purification tests and also in the conductivity record of the P Area deionizers that were run to exhaustion. Operation of exhausted deionizers is to be avoided not only because of the possible release of chloride to the system, but also because they cannot remove chloride from the system. One source of chloride is the Amberlite IRA-400, which is not completely regenerated from the chloride form when purchased.

11998 **(DPST—62-191) SRP moderator impurities and purification deionizers (RTA-631-R).** Baumann, E.W. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 26 Mar 1962. Contract AC09-76SR00001. 12p. NTIS, PC A02. Order Number DE84005583.

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There are more anionic than cationic impurities in the moderator, due to nitric acid and CO_2. The principal impurities removed by the anion resin are NO_3^-, dissolved CO_2, and SO_4^{--}. From an exhausted mixed-bed deionizer, H_2CO_3 is the first component eluted. Nitrate acts as the elutriant, but it does not displace SO_4^{--}. No evidence for gross release of Cl^- was found in minipure resin columns run past initial depletion. I^{131} is released after elution of H_2CO_3 has proceeded for a time. The cationic impurities include Al, Fe, Ca, Mg, Mn, Cr, and Co, and the radionuclides Na^{24}, Np^{239}, and Mn^{56}. In addition to the ionic impurities, particulate matter, consisting mainly of iron and aluminum oxides, is filtered out by the resin to the extent of about 1 wt % of the moist resin. Pressure surges will result in release of this material from the loaded column back into the effluent stream.

11999 **(DPST—63-185) Chloride in 100-Area ion exchange resins.** Baumann, E.W. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 29 Mar 1963. Contract AC09-76SR00001. 7p. NTIS, PC A02/MF A01. Order Number DE84005585.

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Present purchase specifications limit the amount of exchangeable chloride in anion resins to less than 5% of the exchange capacity, or about 5000 ppM chloride in the resin. This amounts to 2 lb. of chloride in a 2:1 anion:cation mixed bed deionizer. The purchase of resins that are chloride-free would reduce substantially the amount of chloride to be handled and stored after decontamination of the deionizer resins. Furthermore, chloride-free resins would probably extend deionizer life by allowing deionizer operation to continue without harmful effects throughout the period when bicarbonate ion is released.

12000 **(DPST—65-130) Analyses during L-2 cycle - RTA 875-R and RTA 877-R.** Baumann, E.W. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 2 Feb 1965. Contract AC09-76SR00001. 13p. NTIS, PC A02/MF A01. Order Number DE84005584.

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Moderator and solids from reactor systems and water that had contacted ion exchange resins were examined by chemical oxygen demand test, thin layer chromatography, x-ray diffraction, infrared spectrometry, spark-source mass spectrometry, microscopy, or other appropriate techniques. The first phase of the work was concerned with investigating the presence of organic material in L-Reactor system. Duolite ARA-366, the new brand of resin with an abnormal fraction of fines, did not release fines into the effluent during normal column operation. Moderator from L-Area contained 5 to 10 times as much oxidizable material as that from P-Area. From a color reaction observed microscopically it was concluded that up to 10% of the solids plugging an instrument line could have been resin. The second phase of the work was concerned with characterization and testing dissolution behavior of target element scale and massive turbidity from the L-2 cycle. The material was found to be principally aluminum oxides that contained carbonate. It was soluble, with effervescence, in mixtures of H_3PO_4 and $K_2Cr_2O_7$. Dissolution tests of alumina in the acid mixture were performed.

12001 **(DPST—65-311) Evaluation of macroreticular anion exchange resin - RTA-893-R.** Baumann, E.W. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 7 Jun 1965. Contract AC09-76SR00001. 6p. NTIS, PC A02. Order Number DE84005571.

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The macroreticular anion exchange resin, Amberlite IRA-900-OH, and an experimental resin from Ionac Chemical Company were irradiated by a ^{60}Co source to doses of 5×10^7 rad and 10^8 rad. These doses approximate or exceed the dose encountered by the deionizer resins in 100-Area service. The loss in exchange capacity and the volume changes of Amberlite IRA-900 on irradiation were similar to those found previously for Amberlite IRA-400. The Ionac experimental resin, which had a considerably lower initial exchange capacity, likewise was not stable to radiation. It is concluded that Amberlite IRA-900 offers no advantage over Amberlite IRA-400 for 100-Area purification service. Since there is little justification for further evaluation of macroreticular resin for 100-Area use, the present work completes RTA-893-R.

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REFER ALSO TO CITATION(S) 11945, 12387, 12494, 12819

12002 **(AD-A—131112/5) Emergency warning systems. Part 2. Warning systems - evaluation guidelines. Final report 1982-1983.** Tanczos, R.C.; Kanen, A.C. (PRC Voorhees, McLean, VA (USA)). Jul 1983. 129p. NTIS, PC A07/MF A01.

This report is the result of research performed to establish guidelines for warning systems as they are used for natural disasters, nuclear power plant accidents, or nuclear attacks. The warning systems include both fixed and mobile sirens, tone alert radios, telephone systems, power line devices. Communications systems that control these warning systems are discussed. Test results of several warning systems are included along with a discussion of sound propagation, hearing, and other items that concern the effectiveness of warning systems.

12003 **(AD-A—133814/4) Evacuation emergency response model coupling atmospheric release advisory capability output. Final report.** Rosen, L.C.; Lawver, B.S.; Buckley, D.W.; Finn, S.P.; Swenson, J.B. (Lawrence Livermore National Lab., CA (USA)). 10 Jan 1983. 87p. (UCRL—53287). NTIS, PC A05/MF A01.

A Federal Emergency Management Agency (FEMA) sponsored project to develop a coupled set of models between those of the Lawrence Livermore National Laboratory (LLNL) Atmospheric Release Advisory Capability (ARAC) system and candidate evacuation models is discussed herein. LLNL and Science Applications, Inc. (SAI), serve as contractor and subcontractor, respectively. This report describes the ARAC system and discusses the rapid computer code developed and the coupling with ARAC output. The computer code is adapted to the use of color graphics as a means to display and convey the dynamics of an emergency evacuation. The model is applied to a specific case of an emergency evacuation of individuals surrounding the Rancho Seco Nuclear Power Plant, located approximately 25 miles southeast of Sacramento, California. The graphics available to the model user for the Rancho Seco example are displayed and noted in detail. Suggestions for future, potential improvements to the emergency evacuation model are presented.

12004 **(AEEW-R—1508) Degraded core accidents: review of aerosol behaviour in the containment of a PWR.** Nichols, A.L.; Walker, B.C. (UKAEA Atomic Energy Establishment, Winfrith). Sep 1981. 42p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83703892.

Sections of this report have been incorporated into ND-R-610(S), PWR degraded core analysis.

Low probability-high consequence accidents have become an important issue in reactor safety studies. Such accidents would involve damage to the core and the subsequent release of radioactive fission products into the environment. Aerosols play a major role in the transport and removal of these fission products in the reactor building containment. The aerosol mechanisms, computer modelling codes and experimental studies used to predict aerosol behaviour in the containment of a PWR are reviewed. There are significant uncertainties in the aerosol source terms and specific recommendations have been made for further studies, particularly with respect to code development and high density aerosol-fission product transport within closed systems.

12005 **(AEEW-R—1518) General description of PWR loss-of-coolant accident analysis methods used in studies at AEE Winfrith (AEEW).** Brittain, I. (UKAEA Atomic Energy Establishment, Winfrith). Aug 1982. 44p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83703893.

This paper gives some of the background to current LOCA analysis methods, including an historical perspective on the development of the methods. General features of the numerical approach common to all methods are described. Specific details are then given for the three methods currently used at AEE Winfrith for best-estimate analyses, namely RELAP4/MOD6, RELAP5 and TRAC-PD2.

12006 **(AEEW-R—1545) Experimental studies of boiling heat transfer and dryout in heat generating particulate beds in water at 1 bar.** Stevens, G.F.; Trenberth, R. (UKAEA Atomic Energy Establishment, Winfrith). Oct 1982. 47p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83703880.

Boiling heat transfer and dryout occurring while a liquid permeates a bed of self-heated particulate material are phenomena of relevance to reactor safety since they control the rate of heat removal from beds of core debris. This report presents results from laboratory experiments in which water was the coolant and the particulate material was metal spheres, usually tin-plated iron shot, heated by passing low voltage alternating current laterally through them. The study covered bed depths up to 200 mm, and particle diameters up to 5.0 mm. Values of dryout heat flux obtained for beds of uniform particles are consistent with those obtained elsewhere using different heating methods. Stratified beds in which a layer of fine particles rests upon a bed of coarse particles can reduce the dryout heat flux to below the level appropriate to either particle size alone, and devices which aid the flow of liquid and/or vapour in a bed can greatly increase the dryout heat flux. The data exhibit a high degree of consistency, and thus will prove to be valuable in testing theoretical models.

12007 **(AEEW-R—1564) Experimental study of the reflooding of a constricted tube in the REFLEX rig.** Denham, M.K.; Elliott, D.F.; Britton-Jones, K.A. (UKAEA Atomic Energy Establishment, Winfrith). Aug 1982. 141p. NTIS (US Sales Only), PC A07/MF A01. Order Number DE83703881.

The Winfrith experimental programme in support of the PWR is focussed on fuel thermal and hydraulic performance under hypothetical accident conditions, and includes studies of reflooding heat transfer of single tubes and fuel rod clusters under simulated accident conditions, aimed at improving understanding of the processes involved and providing data for code development and validation. The work described is part of a study of the possible effects of clad ballooning on ECCS effectiveness. During a large loss of coolant accident the primary circuit will depressurise and the core will overheat. The Zircaloy fuel cladding may swell, partially blocking the coolant passages by the formation of local "balloons". An experiment was carried out in the REFLEX single tube reflooding rig, to study, in a simple geometry, the effect of the partial blockage of the tube on the fluid flow and heat transfer during reflooding. The blockage consisted of a tapering entrance with a flow area 60 percent less than the unconstricted tube, and a tapering exit. The flow could be viewed through windows. Sixty-six refloods were carried out over a pressure range of 1 to 4 bar. Results of these tests are presented.

12008 **(AEEW-R—1590) Inverted annular film boiling and the Bromley model.** Denham, M.K. (UKAEA Atomic Energy Establishment, Winfrith). Jan 1983. 54p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE83704332.

The inverted annular flow regime is one of the regimes which occur in a boiling two phase flow when the wall temperature is too high for the liquid to wet the wall. It is an important flow regime in the cooling of overheated nuclear reactor cores, and also occurs in other engineering plant, for example in the evaporation of cryogenic liquids. This paper reviews the current state of knowledge on inverted annular flow, and goes on to consider the effect of liquid subcooling and flow rate on the heat transfer rate under this condition. A new model, developed from the well known Bromley model, is compared with new data from a single tube reflooding experiment carried out in the REFLEX Rig at Winfrith.

12009 **(ANL/ENG/TM—01) Transport properties of fission product vapors.** Im, K.H.; Ahluwalia, R.K. (Argonne National Lab., IL (USA)). Jul 1983. Contract W-31-109-ENG-38. 138p. NTIS, PC A08/MF A01. Order Number DE84003633.

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Kinetic theory of gases is used to calculate the transport properties of fission product vapors in a steam and hydrogen environment. Provided in tabular form is diffusivity of steam and hydrogen, viscosity and thermal conductivity of the gaseous mixture, and diffusivity of cesium iodide, cesium hydroxide, diatomic tellurium and tellurium dioxide. These transport properties are required in determining the thermal-hydraulics of and fission product transport in light water reactors.

12010 **(CEA-CONF—6813) Dose rate evaluation after accident in a PWR.** Cladel, C.; Duchemin, B.; Le Dieu de Ville, A.; Nimal, B.; Nimal, J.C.; Evrard, J.M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France); CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). May 1983. 8p. (CONF-830538—25). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750445.

From 6. international conference on radiation shielding; Tokyo, Japan (16 May 1983).

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A calculation scheme for the gamma radiation dose rate after accident in a PWR is presented. These studies use a fine description of the geometry and of the fission product inventory. Some results are given and some improvements are planned.

12011 **(CEA-R—5229) Recondensation phenomena of a hot two-phase fluid in the presence of non condensable gases.** Berthoud, G. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France)). Sep 1983. 89p. (In French). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84750475.

The condensation rates obtained during the expansion of a large hot bubble containing non condensable gases in its cold liquid is studied. The failure of theories derived from the Nusselt model for liquid metals led to use the kinetic theory of condensation. The additionnal resistance due to the presence of non condensable gases is expressed by the vapor diffusion through the layer of gases which accumulates at the interface. This model is then used to interprete experiments.

12012 **(CEA-R—5230) Aerosols behavior inside a PWR during an accident.** Hervouet, C. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France); Paris-12 Univ., 94 - Creteil (France)). 1983. 207p. (In French). NTIS (US Sales Only), PC A10/MF A01. Order Number DE84750464.

During very hypothetical accidents occurring in a pressurized water ractor, radioactive aerosols can be released, during coremelt, inside the reactor containment building. A good knowledge of their behavior in the humid containment atmosphere (mass concentration and size distribution) is essential in order to evaluate their harmfulness in case of environment contamination and to design possible filtration devices. Accordingly the Safety Analysis Department of the Atomic Energy Commission uses several computer models, describing the particle formation (BOIL/MARCH), then behavior in the primary circuits (TRAP-MELT), and in the reactor containment building (AEROSOLS-PARFDISEKO-III B). On the one hand, these models have been improved, in particular the one related to the aerosol formation (nature and mass of released particles) using recent experimental results. On the other hand, sensitivity analyses have been performed with the AEROSOLS code which emphasize the particle coagulation parameters: agglomerate shape factors and collision efficiency. Finally, the different computer models have been applied to the study of aerosol behavior during a 900 MWe PWR accident: loss-of-coolant-accident (small break with failure of all safety systems).

12013 **(CEGB-P—2) Sizewell 'B' power station public inquiry: CEGB proof of evidence. CEGB approach to nuclear safety.** Matthews, R.R. (Central Electricity Generating Board, London (UK)). Nov 1982. 84p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE83703873.

Descriptions are given of the CEGB's organizational structure and the policies and practices developed within the Board to achieve safety in its nuclear plants. The division of nuclear safety responsibilities within the CEGB and between the various UK nuclear organizations is outlined. The achievement of nuclear safety and radiological protection in design and in operation is discussed.

12014 **(CEGB-P—16-Vols.1-2) Sizewell 'B' power station public inquiry: CEGB proof of evidence. Degraded core analysis. Vol. 2. Figures, tables and appendices.** Gittus, J. (Central Electricity Generating Board, London (UK)). Nov 1982. 171p. NTIS (US Sales Only), PC A08/MF A01. Order Number DE83703897.

In volume one an analysis is presented of degraded core accidents involving the proposed Sizewell B reactor. Consideration is given to their estimated frequency, the course which they take, the release of radioisotopes from the plant and the radiological consequences of such a release. Volume two contains all the figures, tables and appendices presented as evidence.

12015 **(CEGB-P—17) Sizewell 'B' power station public inquiry: CEGB proof of evidence. Biological effects of radiation and the medical supervision of radiation workers.** Bonnell, J.A. (Central Electricity Generating Board, London (UK)). Nov 1982. 51p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE83703877.

An account is given of the biological effects of exposure to ionizing radiation and of the sources of radiation burden to the population. A brief history of the ICRP follows. Its latest recommendations are outlined and their endorsement in the UK is described. The work of the occupational health services in the protection of radiation workers and the CEGB's research into health physics and radiobiology are discussed. Finally a comparison of the risks from exposures at the CEGB's occupational design criterion with naturally occuring rates of cancer death and genetic effects is presented.

12016 **(CEGB-P—18) Sizewell 'B' power station public inquiry: CEGB proof of evidence. Radiological protection in normal operation.** Pepper, R.B. (Central Electricity Generating Board, London (UK)). Nov 1982. 61p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE83703878.

The practice of radiological protection within the CEGB is described. Health physics at nuclear power stations is discussed. Radiation exposure of operational staff at a PWR and radiation exposure of members of the public are considered. Finally arrangements for dealing with radiological hazards arising during a site emergency are described.

12017 **(CONF-830816—50) Fission product release from fuel under LWR accident conditions.** Osborne, M.F.; Lorenz, R.A.; Norwood, K.S.; Collins, J.L.; Wichner, R.P. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 9p. NTIS, PC A02/MF A01. Order Number DE84004382.

From International meeting on light-water reactor severe accident evaluation; Cambridge, MA, USA (28 Aug 1983).

Three tests have provided additional data on fission product release under LWR accident conditions in a temperature range (1400 to 2000°C). In the release rate data are compared with curves from a recent NRC-sponsored review of available fission product release data. Although the iodine release in test HI-3 was inexplicably low, the other data points for Kr, I, and Cs fall reasonably close to the corresponding curve, thereby tending to verify the NRC review. The limited data for antimony and silver release fall below the curves. Results of spark source mass spectrometric analyses were in agreement with the gamma spectrometric results. Nonradioactive fission products such as Rb and Br appeared to behave like their chemical analogs Cs and I. Results suggest that Te, Ag, Sn, and Sb are released from the fuel in elemental form. Analysis of the cesium and iodine profiles in the thermal gradient tube indicates that iodine was deposited as CsT along with some other less volatile cesium compound. The cesium profiles and chemical reactivity indicate the presence of more than one cesium species.

12018 **(CONF-830816—51) Review of tellurium release rates from LWR fuel elements under accident conditions.** Lorenz, R.A.; Beahm, E.C.; Wichner, R.P. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 10p. NTIS, PC A02/MF A01. Order Number DE84004384.

From International meeting on light-water reactor severe accident evaluation; Cambridge, MA, USA (28 Aug 1983).

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Although fission product tellurium presents a potentially significant radiohazard, its release and transport in source-term experiments is frequently overlooked because it does not possess a readily measurable, gamma emission; moreover, a recent study emphasized noble gas, iodine and cesium release from LWR fuel elements because of the large data base that exists for these materials. Some new tests show that in some cases tellurium may be held up in core material to a greater degree than previously assumed - an observation that prompts a careful reappraisal of the existing tellurium-release data and its chemical foundation.

12019 **(CONF-831111—16) Transient two-phase performance of LOFT reactor coolant pumps.** Chen, T.H.; Modro, S.M. (EG and G Idaho, Inc., Idaho Falls (USA)). 1983. Contract AC07-76ID01570. 11p. NTIS, PC A02/MF A01. Order Number DE84005123.

From ASME winter annual meeting; Boston, MA, USA (13 Nov 1983).

Performance characteristics of Loss-of-Fluid Test (LOFT) reactor coolant pumps under transient two-phase flow conditions were obtained based on the analysis of two large and small break loss-of-coolant experiments conducted at the LOFT facility. Emphasis is placed on the evaluation of the transient two-phase flow effects on the LOFT reactor coolant pump performance during the first quadrant operation. The measured pump characteristics are presented as functions of pump void fraction which was determined based on the measured density. The calculated pump characteristics such as pump head, torque (or hydraulic torque), and efficiency are also determined as functions of pump void fractions. The importance of accurate modeling of the reactor coolant pump performance under two-phase conditions is addressed. The analytical pump model, currently used in most reactor analysis codes to predict transient two-phase pump behavior, is assessed.

12020 **(CONF-8310143—17) Comparison of aerosol code predictions with experimental observations on the behavior of aerosols in steam.** Tobias, M.L. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 20p. NTIS, PC A02/MF A01. Order Number DE84002058.

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

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Several computer codes have been developed to predict the behavior of aerosols in steam, a situation which is expected to occur in a light-water reactor accident. Among the codes with capabilities in this respect are MAEROS (Sandia) AEROMECH (University of Missouri) and NAUA-Mod4 (Karlsruhe). NAUA was specifically developed to model steam-aerosol behavior in hypothetical accidents in pressurized water reactors. It is based upon a series of experiments, in which aerosols of uranium oxide, platinum oxide, and sodium nitrate were generated in a steam atmosphere. Several series of experiments have been conducted in the NSPP vessel using aerosols generated by plasma torch in a steam-air atmosphere. From these experiments we have selected those performed with iron oxide or uranium oxide for comparison with various computer codes, principally NAUA-Mod4. Comparisons of particle size are displayed also. Results of parameter studies to determine the sensitivity of the calculated results to the steam input level, initial particle size, deposition parameters, and assumed particle density are presented.

12021 **(DOE/NE/37254—2) Debris bed cooling following an HCDA in a fast reactor. Final report.** Abdel-Khalik, S.I. (Wisconsin Univ., Madison (USA). Dept. of Nuclear Engineering). 30 Dec 1983. Contract AC02-82NE37254. 270p. NTIS, PC A12/MF A01. Order Number DE84005465.

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Natural convection within simulated core debris beds has been experimentally and theoretically investigated. The effect of heating method on bed behavior has been found to be important. For directly-heated beds, variations of the downward and upward power fraction and Nusselt numbers with bed loading, power density, particle size, overlying fluid layer height and top surface boundary condition have been determined. Generalized correlations for the upward and downward Nusselt numbers as functions of the internal Rayleigh number have been obtained. Particle tracing techniques have been used to visualize the flow patterns within the bed and overlying fluid layer. The temperature distributions within the bed and overlying fluid layer have also been measured. The experimental data have been compared with COMMIX-1A predictions. Poor agreement has been obtained for both the integral quantities, i.e. downward and upward power fractions and Nusselt numbers, as well as the steady state velocity and temperature distributions. The code does not correctly predict either the magnitude or even the trend of the data.

12022 **(DPST—69-566) Seismic resistance of the Savannah River reactors.** List, J.A. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Nov 1969. Contract AC09-76SR00001. 11p. NTIS, PC A02/MF A01. Order Number DE84003684.

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Criteria have been proposed for judging the adequacy of the Savannah River reactors to withstand earthquake forces, and the modifications necessary to conform to these criteria have been determined. This document transmits the reports of these seismic studies and classifies the major reactor systems according to their need-to-function following an earthquake.

12023 **(EGG-M—13483) Analysis of LOFT large break experiments L2-3 and L2-5 using RELAP5/MOD1.** Demmie, P.N. (EG and G Idaho, Inc., Idaho Falls (USA)). 1983. Contract AC07-76ID01570. 6p. (CONF-831047—108). NTIS, PC A02/MF A01. Order Number DE84003027.

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

Calculations of Loss-of-Fluid Test (LOFT) Experimental L2-3 and L2-5 were performed to evaluate input models and assess the capability of the RELAP5/MOD1 computer code to calculate large-break, loss-of-coolant experiments (LOCES) in the LOFT facility. The LOFT facility is a 50 MW (thermal) pressurized water reactor (PWR) experimental facility which was designed to simulate the thermal-hydraulic behavior of a four-loop, commercial pressurized water reactor (PWR) during a hypothetical loss-of-coolant accident (LOCA). It is extensively instrumented to provide detailed information beyond that available in a commercial PWR. Experiments L2-3 and L2-5 were the second and third large-break LOCEs performed in the LOFT facility with its nuclear core producing power. Both experiments simulated a LOCA which results from a 200%, double-ended offset shear break in a cold leg of a four-loop commercial PWR. Results are presented.

12024 **(EGG-M—14883) TRAC-BD1 analysis of a small break test in the ROSA-III facility.** Dallman, R.J. (EG and G Idaho, Inc., Idaho Falls (USA)). 1983. Contract AC07-76ID01570. 7p. (CONF-831111—15). NTIS, PC A02/MF A01. Order Number DE84005122.

From ASME winter annual meeting; Boston, MA, USA (13 Nov 1983).

A best-estimate, TRAC-BD1 computer simulation and subsequent code/data comparison was conducted for Run 912 of the ROSA-III small break LOCA test series. Run 912 is a simulated 5% split break in the recirculation piping, assuming failure of the high pressure core spray. The Organization for Economic Cooperation and Development designated this test as International Standard Problem 12. One objective of this work was to provide results for the United States Nuclear Regulatory Commission's participation in International Standard Problem 12. This work also serves a second objective through its applicability to the Nuclear Regulatory Commission's code assessment objectives. Results from the code-calculated behavior, with comparisons to the experimental data, are presented. These results indicate that TRAC-BD1 gave reasonable results over a wide range of conditions typically encountered with small break LOCAs.

12025 **(EGG-M—15183) Two-dimensional moving finite element development for prediction of rod thermal quench.** Lemmon, E.C. (EG and G Idaho, Inc., Idaho Falls (USA)). 1983. Contract AC07-76ID01570. 8p. (CONF-831111—14). NTIS, PC A02/MF A01. Order Number DE84005121.

From ASME winter annual meeting; Boston, MA, USA (13 Nov 1983).

This paper highlights the development of a two-dimensional moving finite element transient conduction algorithm where the nodes are allowed to move in the axial direction. Typical results of the algorithm for the prediction of the rod thermal quench problem are given. The development employs a weighted residuals type method where the interpolation function is dependent on both the moving geometric position and time. Terms in the resulting equations include the unknown time rate of change of both the temperature and nodal positions. In the axial quenching of a cylindrical rod with internal heat generation, the radial positions of the nodes are

frozen but the axial positions are free to move to minimize all equation residuals. Using this approach, very few nodes are required in the axial direction to reasonably follow the quenching transient. Quadrilateral ring elements (comprised of triangular ring elements) are used. The difficult external convective boundary condition used is a moving step function where the step location is determined by the quench temperature. Of special interest in the development is the use of the calculus of two-dimensional discontinuous functions in a distributional sense, system regularization, and the alteration of a stiff ordinary differential equation solver to obtain solutions.

12026 **(EGG-M—20983) TRAC-BWR development.** Weaver, W.L.; Rouhani, S.Z. (EG and G Idaho, Inc., Idaho Falls (USA)). 1983. Contract AC07-76ID01570. 15p. (CONF-8310143—70). NTIS, PC A02/MF A01. Order Number DE84004353.

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

The TRAC-BD1/MOD1 code containing many new or improved models has been assembled and is undergoing developmental assessment and testing and should be available shortly. The preparation of the manual for this code version is underway and should be available to the USNRC and their designated contractors by April of 1984. Finally work is currently underway on a fast running version of TRAC-BWR which will contain a one-dimensional neutron kinetics model.

12027 **(EGG-M—23783) Assessment of PWR core exit thermocouples during accident and postaccident situations.** Williams, A.C. (EG and G Idaho, Inc., Idaho Falls (USA)). 1983. Contract AC07-76ID01570. 13p. (CONF-8310143—69). NTIS, PC A02/MF A01. Order Number DE84004231.

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

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Several recommendations are being made to minimize the problems of CET performance in accident and postaccident conditions: relax the design and qualification criteria specified in NUREG-0737 to the equivalent of RG 1.97 Category 3 for the in-vessel portion of the system; restrict display of the TC data to indicated temperatures of $< 1600°F$; develop and use diagnostic procedures to determine the validity of the received TC data; and pursue development of improved instrumentation such as the nicrosil-nisil TC for next generation reactors.

12028 **(EGG-M—26183) Trend and pattern analysis of operating reactor data from licensee event reports.** Dennig, R.L.; Hester, O.V.; Gentillon, C.D. (EG and G Idaho, Inc., Idaho Falls (USA); Nuclear Regulatory Commission, Washington, DC (USA)). Oct 1983. Contract AC07-76ID01570. 25p. (CONF-8310248—1). NTIS, PC A02/MF A01. Order Number DE84005683.

From Symposium on national energy issues; Rockville, MD, USA (19 Oct 1983).

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Trend and pattern analysis are oft-cited goals in the review of operational data reported by nuclear utilities to the Nuclear Regulatory Commission (NRC). The NRC Office of Analysis and Evaluation of Operational Data in conjunction with EG and G Idaho, Inc., has developed software which uses contingency table techniques to perform such analysis. The objective of the analysis is to identify outliers and anomolous behavior within the data which would be good candidates for detailed engineering follow-up. This paper briefly discusses the Sequence Coding and Search System (SCSS) Licensee Event Report (LER) data base which contains data in a form amenable to cross-classification, the data retrieval and statistical software employed in conjunction with the SCSS, and the results of a trial application to the 1981 LER data.

12029 **(EGG-M—26382) Influence of liquid holdup in steam generator U-tubes on small break LOCA severity.** Leonard, M.T.; Perryman, J.L.; Johnson, G.W. (Massachusetts Inst. of Tech., Cambridge (USA); EG and G Idaho, Inc., Idaho Falls (USA)). 1983. Contract AC07-76ID01570. 8p. (CONF-831111—13). NTIS, PC A02/MF A01. Order Number DE84005051.

From ASME winter annual meeting; Boston, MA, USA (13 Nov 1983).

The severity of small cold leg break loss-of-coolant accidents has been shown to be influenced by liquid holdup in steam generator U-tubes during pump suction loop seal formation in two experiments performed in the Semiscale Mod-2A facility. The core coolant level can be depressed lower than previously thought possible due to a positive hydrostatic head across the steam generators caused by delayed drainage of liquid from the upflow side of the U-tubes. The significance of a lower core coolant level depression is the potential for a more severe temperature excursion occurring during the coolant boiloff phase subsequent to loop seal clearing and prior to accumulator injection. Presented in this paper are the experimental data analysis and supporting computer code calculations that led to these conclusions.

12030 **(EGG-TFBP—6399) PBF-CANDU fuel element LOCA test experiment predictions.** Smith, R.H.; Martinson, Z.R. (Idaho National Engineering Lab., Idaho Falls (USA)). Oct 1983. Contract AC07-76ID01570. 84p. NTIS, PC A05/MF A01. Order Number DE84005030.

A loss-of-coolant test sponsored jointly by Ontario Hydro and Atomic Energy of Canada Limited (AECL) will be performed in the Power Burst Facility (PBF) at the Idaho National Engineering Laboratory (INEL). The test will provide both an in-reactor evaluation of CANDU fuel element thermal mechanical behavior during a postulated Loss-of-Coolant Accident and an experimental data base for evaluation of the Canadian transient fuel behavior code, ELOCA. The PBF-CANDU test train is comprised of four independently shrouded CANDU design fuel elements installed in symmetric orientations in a modified PBF test assembly. Three of the fuel elements were preirradiated in the NRX reactor to approximately 5000 MWd/t (120 MWh/kgU) at $\sim$ 53 kW/m, and the fourth fuel element is unirradiated. RELAP5 was used to simulate the PBF-CANDU Loss-of-Coolant test. The RELAP5 calculations were used to determine the blowdown valve sequencing required to obtain the prescribed depressurization. The FRAP-T6 code was used to calculate the fuel element response to the simultaneous blowdown and power excursion during the test.

12031 **(GAO/RCED—83-141) Additional improvements needed in physical security at nuclear powerplants.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 13 Jul 1983. 19p. General Accounting Office, Document Handlings and Information Service Facility, P.O. Box 6015, Gaithersburg, MD 20760.

Report to The Chairman, Nuclear Regulatory Commission.

Since the middle 1970's, the Nuclear Regulatory Commission and powerplant operators have taken measures to reduce the vulnerability of powerplants to attempted acts of sabotage. GAO's evaluation disclosed that further improvements can be made by screening nuclear plant employees to reduce the number of potential saboteurs and strengthening the physical security systems to ensure their compatibility with other plant safety systems. The Commission has taken two initiatives addressing these improvements. Therefore, GAO is not making recommendations at this time.

12032 **(GEND—038) Summary of radioactive operations for Zeolite Vitrification Demonstration Program.** Bryan, G.H.; Goles, R.W.; Knox, C.A.; Siemens, D.H. (Pacific Northwest Lab., Richland, WA (USA)). Jan 1984. Contract AC07-76ID01570. 36p. NTIS, PC A03/MF A01. Order Number DE84006260.

The Zeolite Vitrification Demonstration Program (ZVDP) has successfully vitrified the zeolite used in the Submerged Demineralizer System (SDS) at Three Mile Island (TMI) Unit 2 to a borosilicate glass product. Under the ZVDP, the US Department of Energy authorized the Pacific Northwest Laboratory (PNL) to demonstrate the vitrification process on a full scale by use of the in-can melter process. This program was accomplished in two phases. The first phase developed a glass formulation and demonstrated the vitrification process with nonradioactive materials. The second phase received three radioactive liners from the SDS and vitrified the zeolite contained in each. These studies concluded that emission

of melter-generated aerosols is responsible for most radioactive, process-related losses to the off-gas system. Tritium, in the form of water vapor, is the only significant gaseous radioactive effluent generated by the vitrification of TMI zeolite waste.

12033 **(GEND-INF—023-Vol.3) Data integrity review of Three Mile Island Unit 2. Hydrogen burn data. Volume 3.** Jacoby, J.K.; Nelson, R.A.; Nalezny, C.L.; Averill, R.H. (EG and G Idaho, Inc., Idaho Falls (USA)). Sep 1983. Contract AC07-76ID01570. 69p. NTIS, PC A04/MF A01. Order Number DE84004115.

About 10 hours after the March 28, 1979 loss-of-coolant accident began at Three Mile Island Unit 2 (TMI-2), a hydrogen burn occurred inside the Reactor Building. This report reviews and presents data from 16 channels of resistance temperature detectors (RTDs), 2 steam generator pressure transmitters, 16 Reactor Building pressure switches, 2 channels of Reactor Building pressure measurements, and measurements of Reactor Building hydrogen, oxygen, and nitrogen concentrations with regard to their usefulness for determining the extent of the burn and the resulting pressure and temperature excursions inside the building.

12034 **(GEND-INF—041) Evaluation of TMI-2 pressure switches NM-PS-1454 and NM-PS-4174.** Gannon. J.A. (EG and G Idaho, Inc., Idaho Falls (USA)). Nov 1983. Contract AC07-76ID01570. 45p. NTIS, PC A03/MF A01. Order Number DE84004468.

Two pressure switches used to actuate alarms in the TMI-2 Reactor Building Nitrogen Manifold System were selected for investigation. They were subjected to in situ electrical tests, removal, and detailed examination. One unit exhibited no anomalies during in situ testing and survived the accident and subsequent handling, shipping, and storage with no apparent problems. The other unit, however, exhibited an anomaly during in situ testing but appeared to have been mishandled, obscuring its true condition upon removal and rendering analysis of the anomaly impossible. Both units showed evidence that contaminated air entered the switch enclosure, and the second unit also showed evidence of a significant incursion of moisture, possibly from hot-water spraying during the Reactor Building gross decontamination experiment, causing corrosion. Except for the corrosion to the second switch, however, the two units suffered no significant degradation as a result of the accident or from subsequent containment in the post-accident environment. It is recommended that specific attention be paid to the way in which moisture would be prevented from entering the switch compartment.

12035 **(GEND-INF—042) TMI-2 cable/connection program: a look at in situ test data.** Hecker, L.A.; Helbert, H.J. (EG and G Idaho, Inc., Idaho Falls (USA)). Dec 1983. Contract AC07-76ID01570. 57p. NTIS, PC A04/MF A01. Order Number DE84004114.

At the Three Mile Island (TMI) Unit 2 Reactor Building, the Instrumentation and Electrical Program in 1981 initiated a major analysis of cable systems. These cable systems were exposed to varying degrees of radiation, steam, humidity, pressure suppression spray, submergence, and a hydrogen burn event. By studying the electrical and physical properties of selected representative cables and the ways in which these cables responded to the accident and post-accident environments, the Cables/Connections Task group is generating information with which government and the nuclear industry can develop guidelines to make components more radiation resistant, re-evaluate qualification testing procedures and regulatory mandates, and contribute to nuclear power plant safety. This report presents an overview of the TMI Unit 2 cable analysis program and, as examples, the findings for the first 49 cables tested. These cables are in electrical penetration R607.

12036 **(HEDL-SA—2884) Hydrogen mixing in compartments with a high velocity source.** Bloom, G.R.; Postma, A.K. (Hanford Engineering Development Lab., Richland, WA (USA)). Jul 1983. Contract AC06-76FF02170. 6p. NTIS, PC A02/MF A01. Order Number DE84001457.

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Hydrogen mixing test results are analyzed for two simulated high velocity hydrogen-steam releases from postulated small coolant system breaks into the lower compartment of an ice condenser plant. An annular test compartment had a helium-steam or hydrogen-steam source, atmosphere recirculation system and containment vent. The tests demonstrated that the atmosphere of the lower compartment was well mixed for both hydrogen release conditions simulated. Measured local hydrogen or helium concentrations are compared with values calculated assuming perfect gas mixing in individual compartments. Typically, a relative error of less than 25% was observed between calculated and measured values when the average compartment hydrogen or helium concentration was about 4 volume percent. The high velocity hydrogen-steam jet provided the dominant mixing mechanism; however, natural convection and forced gas recirculation played important roles in providing a well mixed atmosphere following termination of the hydrogen source.

12037 (INIS-mf—8559, pp 34-37) **Requirements on PWR reactor design with respect to seismic effects.** Novak, J.; Pecinka, L. (Skoda, Plzen (Czechoslovakia). Zavod Vystavba Jadernych Elektraren). 1981. (In Czech). NTIS (US Sales Only), PC A04/MF A01. (CONF-8004232—).

From Conference on safety and operating reliability of WWER reactor; Srni, Czechoslovakia (28 Apr 1980).

From the seismic point of view the individual parts of a nuclear power plant must be built such as to allow the shutdown of the reactor up to the safe shutdown earthquake level, the removal of after-heat and the prevention of uncontrolled release of radioactivity into the environment. To the level of operating basic earthquake the plant must be designed such as to allow the operation of the reactor for a period of 100 hours from the seismic event without exceeding the permissible annual dose to personnel and population. The possibility of a loss-of-coolant accident owing to a seismic event is reduced mainly by the integrated performance of the primary circuit, the high-strength structure, the insulation of the main components from the shift of the foundations and the use of floating structures. The pressure vessel of the WWER-1000 reactor is therefore placed in a shaft on a support ring and is locked by another support ring. (Z.M.).

12038 (INIS-mf—8559, pp 38-52) **Calculation of pipe systems under seismic load.** Rejent, B. (Sigma, Prague (Czechoslovakia). Vyzkumny Ustav Cerpacich Zarizeni, Potrubi a Armatur). 1981. (In Czech). NTIS (US Sales Only), PC A04/MF A01. (CONF-8004232—).

From Conference on safety and operating reliability of WWER reactor; Srni, Czechoslovakia (28 Apr 1980).

A mathematical model is described of the seismic movement of the pipe system of the nuclear power plant which is formed by a system of bodies (fittings, pumps, steam generators, etc.) connected by pipings. For the primary circuit of the WWER-440 reactor five concentrated masses, each with six degrees of freedom were considered in the first stage of research: the hot and cold leg fitting, the steam generator, the pump and the flexible support of the reactor vessel. (Z.M.).

12039 (INIS-mf—8559, pp 53-62) **Calculation models of PWR reactor components under seismic load.** Pecinka, L. (Skoda, Plzen (Czechoslovakia). Zavod Vystavba Jadernych Elektraren). 1981. (In Czech). NTIS (US Sales Only), PC A04/MF A01. (CONF-8004232—).

From Conference on safety and operating reliability of WWER reactor; Srni, Czechoslovakia (28 Apr 1980).

In dynamic calculations of the internal parts of WWER reactors seismic load may be classified as any other load. Its specificity consists in that it comprises not only the horizontal but also the vertical components. Without loss of accuracy the given system may be divided into three subsystems of which two describe the relative horizontal motion and the third describes vertical motion. From the functional point of view in the calcualtion model of the relative vertical motion the pressure vessel represents the carrier mass and the other parts represent the carried mass. The results of the analysis of the relative vertical motion of the reactor internals under vertical seismic load are briefly described. (Z.M.).

12040 **(LA-UR—83-2949) TRAC analyses for CCTF and SCTF tests and UPTF design/operation.** Williams, K.A. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 27p. (CONF-8310143—9). NTIS, PC A03/MF A01. Order Number DE84001718.

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

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The 2D/3D Program is a multinational (Germany, Japan, and the United States) experimental and analytical nuclear reactor safety research program. The Los Alamos analysis effort is functioning as a vital part of the 2D/3D program. The CCTF and SCTF analyses have demonstrated that TRAC-PF1 can correctly predict multidimensional, nonequilibrium behavior in large-scale facilities prototypical of actual PWR's. Through these and future TRAC analyses the experimental findings can be related from facility to facility, and the results of this research program can be directly related to licensing concerns affecting actual PWR's.

12041 **(LA-UR—83-3451) Hydrogen mixing study (HMS) in LWR type containments.** Travis, J.R. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 21p. (CONF-831255—1). NTIS, PC A02/MF A01. Order Number DE84003813.

From IAEA specialists meeting on hydrogen behaviour and control and related containment loading aspects; Vienna, Austria (12 Dec 1983).

A numerical technique has been developed for calculating the full three-dimensional time-dependent Navier-Stokes equations with multiple speies transport. The method is a modified form of the Implicit Continuous-fluid Eulerian (ICE) technique to solve the governing equations for low Mach number flows where pressure waves and local variations in compression and expansion are not significant. Large density variations, due to thermal and species concentration gradients, are accounted for without the restrictions of the classical Boussinesq approximation. Calculations of the EPRI/HEDL standard problems verify the feasibility of using this finite-difference technique for analyzing hydrogen mixing within LWR containments.

12042 **(NUREG—0519-Suppl.6) Safety Evaluation Report, related to the operation of La Salle County Station, Units 1 and 2 (Docket Nos. 50-373 and 50-374).** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Nov 1983. 18p. NTIS, PC A02/MF A01 - GPO $3.00. Order Number DE84900723.

Supplement No. 6 to the Safety Evaluation Report of Commonwealth Edison Company's application for a license to operate its La Salle County Station, Unit 2, located on Brookfield Township, La Salle County, Illinois, has been prepared by the Office of Nuclear Reactor Regulation of the US Nuclear Regulatory Commission. This supplement is to update our evaluations on Unit 2 issues identified in the previous Safety Evaluation Report and Supplements that need resolution prior to issuance of the operating license for Unit 2.

12043 **(NUREG—0675-Suppl.20) Safety evaluation report related to the operation of Diablo Canyon Nuclear Power Plant, Units 1 and 2 (Docket Nos. 50-275 and 50-323).** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Dec 1983. 63p. NTIS, PC A04/MF A01 - GPO $4.50. Order Number DE84900672.

Supplement 20 to the Safety Evaluation Report for Pacific Gas and Electric Company's application for licenses to operate Diablo Canyon Nuclear Power Plant, Unit 1 and Unit 2 (Docket Nos. 50-275 and 50-323), has been prepared by the Office of Nuclear Reactor Regulation of the US Nuclear Regulatory Commission. This supplement reports on the verification effort for Diablo Canyon Unit 1 that was performed between November 1981 and the present in response to Commission Order CLI-81-30 and an NRC letter of November 19, 1981 to the licensee. Specifically, Supplement 20 addresses those issues and other matters identified in Supplements 18 and 19 that must be resolved prior to Unit 1 achieving criticality and operating at power levels up to 5% of rated full power. This SER Supplement applies only to Diablo Canyon Unit 1.

12044 **(NUREG—0675-Suppl.21) Safety Evaluation Report related to the operation of Diablo Canyon Nuclear Power Plant, Units 1 and 2 (Docket Nos. 50-275 and 50-323).** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Dec 1983. 273p. NTIS, PC A12/MF A01 - GPO $7.00. Order Number DE84900665.

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Supplement 21 to the Safety Evaluation Report for Pacific Gas and Electric Company's application for licenses to operate Diablo Canyon Nuclear Power Plants, Unit 1 and 2 (Docket Nos. 50-275 and 50-323), has been prepared by the Office of Nuclear Reactor Regulation of the US Nuclear Regulatory Commission. This supplement reports on the status of the staffs resolution of outstanding allegations or concerns pertaining to Diablo Canyon as directed by the Commission on October 28, 1983. The status of a number of the allegations or concerns are considered sensitive and not addressed here since disclosure would impede possible enforcement actions or identify allegers that have requested anonymity.

12045 **(NUREG—0713-Vol.4) Occupational radiation exposure at commercial nuclear power reactors 1982. Annual report. Volume 4.** Brooks, B.G. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Resource Management). Dec 1983. 132p. NTIS, PC A07/MF A01 - GPO $5.00. Order Number DE84900660.

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This report presents an updated compilation of occupational radiation exposures at commercial nuclear power reactors for the years 1969 through 1982. This year's report contains data received from the 74 light water cooled reactors (LWRs) and one high temperature gas cooled reactor (HTGR). The total number of personnel monitored at LWRs in 1982 was 129,275, a slight increase from that found in 1982 (124,504). The number of workers that received measurable doses during 1982 was 84,322 which is about 2000 more than that found in 1981. The total collective dose at LWRs for 1982 is estimated to be 52,190 man-rems, which is about 2000 man-rems less than that reported in 1981. The result was that the average measurable dose per worker decreased to 0.62 rems, and the averaged collective dose per reactor decreased by about 70 man-rems to a value of 705 man-rems. The collective dose per megawatt-year of generated electricity by each reactor also decreased slightly to an average value of 1.6 man-rems per megawatt-year. Personal identification and exposure information has been collected and computerized for some 250,000 of terminating reactor personnel. 9 figures, 20 tables.

12046 **(NUREG—0793-Suppl.3) Safety Evaluation Report, related to the operation of Midland Plant, Units 1 and 2 (Docket Nos. 50-329 and 50-330).** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Nov 1983. 119p. NTIS, PC A06/MF A01 - GPO $5.50. Order Number DE84900707.

This report supplements the Safety Evaluation Report related to the Operation of Midland Plant, Units 1 and 2 (SER) (NUREG-0793) issued in May 1982 by the Office of Nuclear Reactor Regulation of the US Nuclear Regulatory Commission with respect to the application filed by Consumers Power Company, as applicant and owner, for licenses to operate the Midland Plant, Units 1 and 2 (Docket Nos. 50-329 and 50-330). The facility is located in the city of Midland in Midland County, Michigan. This supplement provides recent information regarding resolution of several open times identified in the SER. Certain confirmatory issues identified in the SER also are addressed.

12047 **(NUREG—0797-Suppl.4) Safety Evaluation Report, related to the operation of Commanche Peak Steam Electric Station, Units 1 and 2 (Docket Nos. 50-445 and 50-446).** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Nov 1983. 49p. NTIS, PC A03/MF A01 - GPO $4.25. Order Number DE84900695.

Supplement No. 4 to the Safety Evaluation Report (SER) related to the operation of the Comanche Peak Steam Electric Station, Units 1 and 2, has been prepared by the Office of Nuclear Re-

actor Regulation of the US Nuclear Regulatory Commission. The facility is located in Somervell County, Texas. Subject to favorable resolution of the items identified in this supplement, the staff concludes that the facility can be operated by the applicant without endangering the health and safety of the public. This document provides the NRC staff's evaluation of the outstanding and confirmatory issues that have been resolved since Supplement No. 3 was issued in March 1983, and addresses changes to the SER and its earlier supplements which have resulted from the receipt of additional information from the applicant during the period of October 1982 through August 1983.

12048 **(NUREG—0820-Suppl.1) Integrated Plant Safety Assessment, Systematic Evaluation Program, Palisades Plant (Docket No. 50-255).** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Nov 1983. 34p. NTIS, PC A03/MF A01 - GPO $3.75. Order Number DE84900721.

This report documents the review completed under the SEP for those issues that required refined engineering evaluations or the continuation of ongoing evaluations after the Final IPSAR for the Palisades Plant was issued. The review has provided for (1) an assessment of the significance of differences between current technical positions on selected safety issues and those that existed when the Palisades Plant was licensed, (2) a basis for deciding on how these differences should be resolved in an integrated plant review, and (3) a documented evaluation of plant safety when the supplement to the Final IPSAR and the Safety Evaluation Report for converting the license from a provisional to a full-term license have been issued. The Final IPSAR and its supplement will form part of the bases for considering the conversion of the provisional operating license to a full-term operating license.

12049 **(NUREG—0857-Suppl.5) Safety Evaluation Report, related to the operation of Palo Verde Nuclear Generating Station, Units 1, 2, and 3 (Docket Nos. STN 50-528, STN 50-529, and STN 50-530).** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Nov 1983. 112p. NTIS, PC A06/MF A01 - GPO $5.00. Order Number DE84900694.

Supplement No. 5 to the Safety Evaluation Report for the application filed by Arizona Public Service Company, et al, for licenses to operate the Palo Verde Nuclear Generating Station, Units 1, 2 and 3 (Docket Nos. STN 50-528/529/530), located in Maricopa County, Arizona has been prepared by the Office of Nuclear Reactor Regulation of the Nuclear Regulatory Commission. The purpose of this supplement is to update the Safety Evaluation Report by providing an evaluation of (1) additional information submitted by the applicants since Supplement No. 4 was issued and (2) matters that the staff had under review when Supplement No. 4 was issued.

12050 **(NUREG—0876-Suppl.3) Safety Evaluation Report, related to the operation of Byron Station, Units 1 and 2 (Docket Nos. STN 50-454 and STN 50-455).** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Nov 1983. 28p. NTIS, PC A03/MF A01 - GPO $3.75. Order Number DE84900719.

Supplement No. 3 to the Safety Evaluation Report related to Commonwealth Edison Company's application for licenses to operate the Byron Station, Units 1 and 2, located in Rockvale Township, Ogle County, Illinois, has been prepared by the Office of Nuclear Reactor Regulation of the US Nuclear Regulatory Commission. This supplement reports the status of certain items that had not been resolved at the time of publication of the Safety Evaluation Report.

12051 **(NUREG—0933) Prioritization of generic safety issues.** Emrit, R.; Minners, W.; VanderMolen, H.; Colmar, R.; Thatcher, D.; Pittman, J.; Milstead, W.; Riggs, R.; Sege, G.; Matthews, P. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Dec 1983. 773p. NTIS, PC A99/MF A01 - GPO $16.00. Order Number DE84900648.

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This report presents the priority rankings for generic safety issues related to nuclear power plants. The purpose of these rankings is to assist in the timely and efficient allocation of NRC resources for the resolution of those safety issues that have a significant potential for reducing risk. The report focuses on the prioritization of generic safety issues. Issues primarily concerned with the licensing process or environmental protection and not directly related to safety have been excluded from prioritization. The prioritized issues include: TMI Action Plan items under development; previously proposed issues covered by Task Action Plans, except issues designated at Unresolved Safety Issues (USIs) which had already been assigned high priority; and newly-proposed issues. Future supplements to this report will include the prioritization of additional issues. The safety priority rankings are HIGH, MEDIUM, LOW, and DROP and have been assigned on the basis of risk significance estimates, the ratio of risk to costs and other impacts estimated to result if resolutions of the safety issues were implemented, and the consideration of uncertainties and other quantitative or qualitative factors. To the extent practical, estimates are quantitative.

12052 **(NUREG—0981) NRC/FEMA operational response procedures for response to a commercial nuclear reactor accident.** (Nuclear Regulatory Commission, Washington, DC (USA); Federal Emergency Management Agency, Washington, DC (USA)). Nov 1983. 24p. (FEMA—51). NTIS, PC A02/MF A01 - GPO $3.25. Order Number DE84900726.

Procedures have been developed by the US Nuclear Regulatory Commission (NRC) and the Federal Emergency Management Agency (FEMA) which provide the response teams of both agencies with the steps to be taken in responding to an emergency at a commercial nuclear power plant. The emphasis of these procedures is mainly on the interface between NRC and FEMA at their respective Headquarters and Regional Offices and at the various sites at which such an emergency could occur. Detailed procedures are presented that cover for both agencies, notification schemes and manner of activation, organizations at Headquaters and the site, interface procedures, coordination of onsite and offsite operations, the role of the Senior FEMA Official, and the cooperative efforts of each agency's public information staff.

12053 **(NUREG—0995) Safety evaluation report related to plant restart of Salem Nuclear Generating Station, Unit Nos. 1 and 2 (Docket Nos. 50-272 and 50-311).** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Dec 1983. 117p. NTIS, PC A06 - GPO $5.00. Order Number DE84900657.

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On February 22 and 25, 1983, the Salem Unit 1 reactor control rods failed to insert upon receipt of a manually initiated trip signal, however, the rods did insert and shut down the plant. These events were of major safety concern because the automatic reactor trip capability was not available. Evaluation of these events and the circumstances leading up to them revealed a number of issues that require resolution. This safety evaluation report briefly describes the NRC and licensee actions to address and resolve equipment, operator procedures, training and response, and management issues identified by the NRC evaluation of the two events at Salem Unit 1. Actions for Salem as identified in this report fall in two groups: (1) actions that were required to be satisfactorily resolved before plant startup; and (2) actions that could be completed after restart but which were required to complement the pre-startup items. The actions required prior to the restart of Unit 1 were also implemented on Unit 2 prior to its restart.

12054 **(NUREG—1013) Technical specifications, LaSalle County Station, Unit No. 2 (Docket No. 50-374). Appendix A to License No. NPF-18.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Dec 1983. 478p. NTIS, PC A21/MF A01 - GPO $9.50. Order Number DE84900596.

The LaSalle County Station, Unit No. 2, Technical Specifications were prepared by the US NRC to set forth the limits, operating conditions, and other requirements applicable to a nuclear reactor facility as set forth in Section 50.36 of 10 CFR Part 50 for the protection of the health and safety of the public.

12055 **(NUREG—1019) Safety evaluation report related to steam generator tube repair and return to operation Three Mile Island Nuclear Station, Unit No. 1 (Docket No. 50-289).** Silver, H. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Nov 1983. 198p. NTIS, PC A09/MF A01 - GPO $6.00. Order Number DE84900586.

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Based on our evaluation of the steam generator tube repair method and of subsequent operation using the repaired steam generators, we conclude that the steam generator tube kinetic expansion process is acceptable, that applicable GDC have been met, and that there is reasonable assurance that the health and safety of the public will not be endangered by subsequent operation of the plant.

12056 **(NUREG—1023) Safety Evaluation Report, related to the renewal of the operating license for the critical experiment facility of the Rensselaer Polytechnic Institute (Docket No. 50-225).** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Oct 1983. 61p. NTIS, PC A04/MF A01 - GPO $4.50. Order Number DE84900706.

This Safety Evaluation Report for the application filed by the Rensselaer Polytechnic Institute (RPI) for a renewal of operating license CX-22 to continue to operate a critical experiment facility has been prepared by the Office of Nuclear Reactor Regulation of the US Nuclear Regulatory Commission. The facility is owned and operated by Rensselaer Polytechnic Institute and is located at a site in the city of Schenectady, New York. The staff concludes that this critical facility can continue to be operated by RPI without endangering the health and safety of the public.

12057 **(NUREG—1024) Technical specifications - enhancing the safety impact.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of the Executive Director for Operations). Nov 1983. 32p. NTIS, PC A03/MF A01 - GPO $3.75. Order Number DE84900709.

This report documents the work of an interoffice, interdisciplinary, NRC Task Group established in August 1983 to identify the scope and nature of problems with surveillance testing in current Technical Specifications and to develop alternative approaches that will provide better assurance that surveillance testing does not adversely impact safety. The Task Group concluded that some of the Technical Specifications have the potential for adversely affecting safety and some do not appear to be cost effective. The Task Group developed five recommendations for improvement. 15 references.

12058 **(NUREG/BR—0051-Vol.5-No.3) Power reactor events, May-June 1983. Volume 5, No. 3.** Massaro, S.A.; Trenery, S.E. (eds.). (Nuclear Regulatory Commission, Washington, DC (USA). Office for Analysis and Evaluation of Operational Data). Dec 1983. 42p. NTIS, PC A03/MF A01 - GPO. Order Number DE84900690.

This bimonthly compiles operating experience information about commercial nuclear power plants. Summaries of noteworthy events and listings, and/or abstracts of NRC and other documents that discuss safety-related or possible generic issues are included. (DLC)

12059 **(NUREG/CR—2655) Evaluation of the prompt alerting systems at four nuclear power stations.** Towers, D.A.; Anderson, G.S.; Keast, D.N.; Kenoyer, J.L.; Desrosiers, A.E. (Bolt, Beranek and Newman, Inc., Cambridge, MA (USA); Pacific Northwest Lab., Richland, WA (USA)). Sep 1982. Contract AC06-76RL01830. 267p. (PNL—4226). NTIS MF A01 - GPO $8.00. Order Number DE82022267.

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This report presents evaluations of the prompt notification siren systems at the following four US nuclear power facilities: Trojan, Three Mile Island, Indian Point, and Zion. The objective of these evaluations was to provide examples of an analytical procedure for predicting siren-system effectiveness under specific conditions in the 10-mile emergency planning zone (EPZ) surrounding nuclear power plants. This analytical procedure is discussed in report No. PNL-4227.

12060 **(NUREG/CR—2679-2) Advanced reactor safety research. Quarterly report, April-June 1982. Volume 22.** (Sandia National Labs., Albuquerque, NM (USA)). Oct 1983. Contract AC04-76DP00789. 449p. (SAND—82-0904-2). NTIS, PC A19/MF A01 - GPO. Order Number DE84004667.

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Overall objective of this work is to provide NRC a comprehensive data base essential to (1) defining key safety issues, (2) understanding risk-significant accident sequences, (3) developing and verifying models used in safety assessments, and (4) assuring the public that power reactor systems will not be licensed and placed in commercial service in the United States without appropriate consideration being given to their effects on health and safety. This report describes progress in a number of activities dealing with current safety issues relevant to both light water and breeder reactors. The work includes a broad range of experiments to simulate accidental conditions to provide the required data base to understand important accident sequences and to serve as a basis for development and verification of the complex computer simulation models and codes used in accident analysis and licensing reviews. Such a program must include the development of analytical models, verified by experiment, which can be used to predict reactor and safety system performance under a broad variety of abnormal conditions. Current major emphasis is focused on providing information to NRC relevant to (1) its deliberations and decisions dealing with severe LWR accidents, and (2) its safety evaluation of the proposed Clinch River Breeder Reactor.

12061 **(NUREG/CR—2800-Suppl.2) Guidelines for nuclear power plant safety issue prioritization information development. Supplement 2.** Andrews, W.B.; Gallucci, R.H.V.; Konzek, G.J.; Heaberlin, S.W.; Fecht, B.A.; Allen, C.H.; Allen, R.D.; Bickford, W.E., Carbaugh, E.H.; Lewis, J.R. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1983. Contract AC06-76RL01830. 425p. (PNL—4297-Suppl.2). NTIS, PC A18/MF A01 - GPO $8.50. Order Number DE84005647.

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This is the third in a series of reports to document the use of a methodology developed by the Pacific Northwest Laboratory to calculate, for prioritization purposes, the risk, dose and cost impacts of implementing resolutions to reactor safety issues (NUREG/CR-2800, Andrews et al. 1983). This report contains results of issue-specific analyses for 31 issues. Each issue was considered within the constraints of available information as of summer 1983, and two staff-weeks of labor. The results are referenced, as one consideration in setting priorities for reactor safety issues, in NUREG-0933, A Prioritization of Generic Safety Issues.

12062 **(NUREG/CR—2815) Probabilistic safety analysis procedures guide.** Papazoglou, I.A.; Bari, R.A.; Buslik, A.J.; Hall, R.E.; Ilberg, D.; Samanta, P.K.; Teichmann, T.; Youngblood, R.W.; El-Bassioni, A.; Fragola, J. (Brookhaven National Lab., Upton, NY (USA)). Jan 1984. Contract AC02-76CH00016. 232p. (BNL-NUREG—51559). NTIS, PC A11/MF A01 - GPO $6.50. Order Number DE84005744.

A procedures guide for the performance of probabilistic safety assessment has been prepared for interim use in the Nuclear Regulatory Commission programs. The probabilistic safety assessment studies performed are intended to produce probabilistic predictive models that can be used and extended by the utilities and by NRC to sharpen the focus of inquiries into a range of tissues affecting reactor safety. This guide addresses the determination of the probability (per year) of core damage resulting from accident initiators internal to the plant and from loss of offsite electric power. The scope includes analyses of problem-solving (cognitive) human errors, a determination of importance of the various core damage accident sequences, and an explicit treatment and display of uncertainties for the key accident sequences. Ultimately, the guide will be augmented to include the plant-specific analysis of in-plant processes (i.e., containment performance) and the risk associated with external accident initiators, as consensus is developed regarding suitable methodologies in these areas. This guide provides the structure of a probabilistic safety study to be performed, and indicates

what products of the study are essential for regulatory decision making. Methodology is treated in the guide only to the extent necessary to indicate the range of methods which is acceptable; ample reference is given to alternative methodologies which may be utilized in the performance of the study.

12063 **(NUREG/CR—3049) Closeout of IE Bulletin 79-15: deep draft pump deficiencies.** Dean, R.S.; Littleton, W.E.; Hennick, A. (Parameter, Inc., Elm Grove, WI (USA)). Nov 1983. 42p. NTIS, PC A03/MF A01 - GPO $3.75. Order Number DE84900710.

In 1978 serious manufacturing deficiencies in deep draft pumps were found in one facility. Similar deficiencies, as well as design deficiencies, were identified at about the same time in three other facilities which required pump rework and design changes, followed by extensive operational testing. These occurrences raised questions concerning this type of pump in safety-related applications where there was not sufficient pre-operational testing or operating experience to assure long term operability. IE Bulletin 79-15 was issued to alert all facilities to the potential problem, to acquire information to determine the extent of the problem, and to request corrective action in facilities where the problem was found. Review of utility responses to the Bulletin by NRC resulted in adding the evaluation of long term operability of deep draft pumps in safety-related applications to the normal licensing process for plants under construction. The operating plants where response information is judged not adequate to assure long term reliability are listed by Regions in Appendix C together with proposed followup testing to satisfactorily assure long term operability and close out the Bulletin. There are nine of these plants out of a total of 74 operating units. Bulletin status remains open for one other facility where followup of response commitments, but no pump testing for assuring long term operability, is proposed.

12064 **(NUREG/CR—3233) Effect of resolution of the Millstone Point Unit 1 Systematic Evaluation Program issues on probabilistic calculations of risk.** Spulak, R.G. Jr.; Stack, D.W.; Amico, P.; Gallagher, D. (Sandia National Labs., Albuquerque, NM (USA); Science Applications, Inc., Albuquerque, NM (USA)). Dec 1983. Contract AC04-76DP00789. 92p. (SAND—82-2429). NTIS, PC A05/MF A01 - GPO $4.50. Order Number DE84004666.

The US NRC Systematic Evaluation Program (SEP) identifies deviations from current licensing requirements for older nuclear power plants. The Millstone Point Unit 1 (Millstone-1) plant is the first plant in the SEP which has had a probabilistic risk assessment (PRA) performed on it (as part of the Interim Reliability Evaluation Program, IREP). Sandia was requested to calculate the effect on risk of resolving the deviations identified by the SEP for Millstone-1. The results of the IREP Millstone-1 PRA were recalculated incorporating resolution of the issues which were within the scope of the original PRA. Of the 19 issues analyzed in detail, we calculated no reduction in core melt frequency, exposure, and risk for 12 issues, less than 2% reduction for 5 issues, and ~ 15% reduction for 2 interrelated issues if implemented together. These numbers should be viewed in the context of the very large uncertainties in PRA methodology and data. No attempt at cost/benefit analysis was made. The deviations not analyzed were generally those concerning the plant's response to external events such as flooding and earthquakes.

12065 **(NUREG/CR—3314) PWR FLECHT SEASET 163-Rod Bundle Flow Blockage Task data report. NRC/EPRI/Westinghouse report No. 13, August-October 1982.** Loftus, M.J.; Hochreiter, L.E.; McGuire, M.F.; Valkovic, M.M. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Nuclear Energy Systems Div.). Oct 1983. 802p. (EPRI-NP—3268; WCAP—10307). NTIS, PC A99/MF A01 - GPO $20.00. Order Number DE84900702.

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This report presents data from the 163-Rod Bundle Blow Blockage Task of the Full-Length Emergency Cooling Heat Transfer Systems Effects and Separate Effects Test Program (FLECHT SEASET). The task consisted of forced and gravity reflooding tests utilizing electrical heater rods with a cosine axial power profile to simulate PWR nuclear core fuel rod arrays. These tests were designed to determine effects of flow blockage and flow bypass on reflooding behavior and to aid in the assessment of computational models in predicting the reflooding behavior of flow blockage in rod bundle arrays.

12066 **(NUREG/CR—3342) Probabilistic models for operational and accidental loads on seismic category I structures.** Hwang, H.; Wang, P.C.; Reich, M. (Brookhaven National Lab., Upton, NY (USA)). Jun 1983. Contract AC02-76CH00016. 57p. (BNL-NUREG—51682). NTIS, PC A04/MF A01 - GPO. Order Number DE84002897.

Probabilistic models for various loads acting on the seismic category I structures are the important ingredients required for the development of probability-based reliability analysis method. An extensive effort was made to collect data on operational and accidental loads so that probabilistic models for these loads can be formulated. This effort was carried out by: (1) reviewing the available documents, and (2) conducting a consensus estimation survey. Results of these efforts are summarized in this report.

12067 **(NUREG/CR—3424) Equipment qualification research: test program and failure analysis of Class 1E solenoid valves.** Paulson, D.V.; Shook, T.A.; Bacanskas, V.P.; Carfagno, S.P. (Franklin Research Center, Philadelphia, PA (USA)). Nov 1983. 257p. NTIS, PC A12/MF A01 - GPO $7.00. Order Number DE84900712.

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This report documents the results of an equipment qualification research test program performed on ASCO solenoid valves. The valves were subjected to accelerated aging which included 50 Mrd of gamma radiation aging and accelerated thermal aging at 268°F (131°C). All valves performed satisfactorily during the seismic test. Of the seven valves exposed to the LOCA/MSLB simulation, only a metal-seated valve functioned properly throughout without leakage. At the conclusion of the post-LOCA functional testing, a failure analysis was undertaken to determine the failure mode(s) for each valve. The failure analysis included electrical testing of solenoid coils, controlled disassembly of valves, macro- and microscopic examination of internal parts, Shore A durometer testing of elastomeric components, and mass spectrometer analysis of several components. It was concluded that (1) the use of nitrogen to pressurize the valves during thermal aging severely inhibited the aging process since the majority of EPDM components were blanketed in nitrogen, and (2) operational cycling at the elevated thermal aging temperature may have produced stresses not representative of in-service use.

12068 **(NUREG/CR—3463) Evaluation of HECTR predictions of hydrogen transport.** Wester, M.J.; Camp, A.L. (Sandia National Labs., Albuquerque, NM (USA)). Sep 1983. Contract AC04-76DP00789. 92p. (SAND—83-1814). NTIS, PC A05/MF A01. Order Number DE84004276.

A computer program named HECTR has been developed as part of an NRC sponsored program to investigate hydrogen behavior in light water reactors. This report describes the evaluation of HECTR's multicompartment gas transport model by both analytical and experimental comparisons. In general, HECTR performed well, producing good quantitative agreement with many of the experimental results and qualitatively agreeing in all other cases. HECTR was also compared with an earlier version of itself in a set of combined transport/combustion calculations. In some cases, dramatic differences, due to changes in HECTR's numerical modelling, were observed. This study demonstrated that HECTR is a useful tool for making inexpensive parametric studies of hydrogen transport (and combustion) for a wide range of situations.

12069 **(NUREG/CR—3531) Review of the Seabrook Units 1 and 2 auxiliary feedwater system reliability analysis.** Fresco, A.; Youngblood, R.; Papazoglou, I.A. (Brookhaven National Lab., Upton, NY (USA)). Feb 1984. Contract AC02-76CH00016. 194p. (BNL-NUREG—51723). NTIS, PC A09/MF A01 - GPO $6.00. Order Number DE84006680.

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This report presents the results of a review of the Emergency Feedwater System Reliability Analysis for Seabrook Nuclear Station Units 1 and 2. The objective of this report is to estimate the probability that the Emergency Feedwater System will fail to perform its mission for each of three different initiators: (1) loss of main feedwater with offsite power available, (2) loss of offsite power, (3) loss of all ac power except vital instrumentation and control 125 VDC/120 VAC power. The scope, methodology, and failure data are prescribed by NUREG-0611, Appendix III. The results are compared with those obtained in NUREG-0611 for other Westinghouse plants.

12070 **(NUREG/CR—3541) Measures of the risk impacts of testing and maintenance activities.** Vesely, W.E.; Davis, T.C.; Saltos, N. (Battelle Columbus Labs., OH (USA)). Nov 1983. 162p. (BMI—2109). NTIS, PC A08/MF A01 - GPO $5.50. Order Number DE84900704.

This report is a companion to Measures of Risk Importance and Their Applications (NUREG/CR-3385). This report focuses on quantifying the importance of online tests, maintenances, repairs in controlling the risk. The importance measures which are defined are applied to evaluate the corrective and preventative benefits of online testing, maintenance, and repair. The corrective and preventative benefits are measured in terms of the impacts in risk which result. The corrective value of a repair or unscheduled maintenance action is termed the restoration worth of the action and is defined to be the reduction in risk which results from restoring a failed component or system. The preventative value of a test or maintenance action is termed the expected worth of the action and is defined to be the expected risk reduction from performing the action. There is a great deal of information obtainable from these kinds of measures which can be simply calculated in any PRA and enhance the usefulness of the PRA. If there is a general message from this work regarding risk assurance programs and inspection programs it is on the usefulness of risk analysis techniques in these programs. To be most effective with regard to risk control inspection programs and risk assurance programs directed at testing and maintenance should be guided by the risk impacts of the test or maintenance.

12071 **(NUREG/CR—3543) Survey of operating experience from LERs to identify aging trends.** Murphy, G.A.; Gallaher, R.B.; Casada, M.L.; Hoy, H.C. (Oak Ridge National Lab., TN (USA)). Jan 1984. Contract W-7405-ENG-26. 43p. (ORNL/NSIC—216). NTIS, PC A03/MF A01 - GPO. Order Number DE84005047.

The results of a study utilizing the ORNL Nuclear Operations Analysis Center (NOAC) computer files of operating experience reports [licensee event reports (LERs), abnormal occurrences, etc.] are summarized. In this study, specific time-related degradation mechanisms are identified as possible causes of a reportable occurrence. Data collected on domestic commercial nuclear power plants covering 1969 to 1982 yielded over 5800 events attributable to age-related failures. Of these events, 2795 were attributable to instrument drift, which are addressed separately in the report. The remaining events (3098) were reviewed, and data were collected for each event, identifying the specific system, component, and subpart; the information included-age-related failure mechanism, severity of failure, and method of detection of the failure. About two-thirds of the failures were judged to be degraded, with one-third listed as catastrophic failures. No events were found to be incipient failures because an LER is prepared only on degraded or catastrophic failure conditions that place plant operation outside the Technial Specifications. The study found that information desired for evaluation of aging effects (equipment, age, service life, and environment) was seldom available from LERs. This reflects the intent of the LER system as a regulatory instrument, rather than an engineering data collection system.

12072 **(NUREG/CR—3577) Measurement of countercurrent phase separation and distribution in a two-dimensional test section.** Bukhari, K.M.; Lahey, R.T. Jr. (Rensselaer Polytechnic Inst., Troy, NY (USA). Dept. of Nuclear Engineering). Jan 1984. 221p. NTIS, PC A10/MF A01 - GPO $6.50. Order Number DE84900662.

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The degree of phase separation that occurs in the core of a pressurized water reactor (PWR) during various postulated accidents is an important consideration for studying the course of events during such accidents. The dependence of countercurrent phase separation and distribution phenomena on flow quality, mass flux and system geometry was studied experimentally in a two-dimensional (2-D) test section. A two-phase (air/water) mixture flowed upwards and single-phase water flowed downward along one side of the test section. This countercurrent flow configuration was intended to simulate the so-called chimney effect in the diabatic JAERI 2-D experiments in Japan. A large air/water loop used with a 91.44 cm x 91.44 cm x 1.27 cm test section to study phase separation and distribution effects. A traversing single beam gamma-densitometer was used to measure the chordal average void fractions at several elevations along the test section. Cross-plots between various flow conditions and geometries were made. An error analysis giving the total error in the void fraction measurements was also performed. High speed photographs were also made of the flow structure, to provide information on flow regimes. The photographic records and the void fraction and hydraulic inflow/outflow data are presented in a form suitable for the assessment of advanced generation computer codes (e.g., TRAC).

12073 **(OEFZS—4226) Post-accident hydrogen control in GKT-containment.** Komurka, M. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H.). Jun 1983. 74p. (In German). (RS—222/83). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83703887.

The maximum possible temperature and pressure rise is analysed by assuming hydrogen deflagration with no heat loss to the vessel walls for hydrogen concentrations up to 10 Vol%. As an alternative to inerting, a hydrogen control system of air dilution and recombiners (based on controlled venting by passing the vented gas through the delay line of the gas treatment system) is recommended. The combination of hydrogen control with control of noble gas radioactivity is thought to have a positive effect on safety.

12074 **(PNL-SA—11651) Ex-reactor PCI experiments.** Barner, J.O.; Fitzsimmons, D.E.; Lanning, D.D.; Williford, R.E. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1983. Contract AC06-76RL01830. 18p. (CONF-8310143—50). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84003354.

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

A small fraction of light-water reactor (LWR) fuel rods experience breach of the cladding due to pellet-cladding interaction (PCI). The PCI failure mechanism is attributed to stress-corrosion cracking (SCC), i.e., chemically-assisted fracture of the cladding under the mechanical load exerted by the thermally-expanded fuel pellets. Many of the out-of-reactor experiments that have been performed to investigate the SCC phenomenon have used nonirradiated cladding and simulated fission products. It is possible, however, that an irradiation-induced mechanism in the cladding may be a primary cause of PCI failures, e.g., irradiation hardening, in combination with localized stress concentrations. This work was initiated to study the strain/failure behavior of UO_2-zircaloy cladding system using simulated fuel rods that utilized irradiated cladding which had not been exposed to fission products. Simulated fuel rod tests were conducted in a pressurized water loop under nearly-prototypic flowing coolant conditions of 300°C and 10.3 MPa (1500 psig).

12075 **(UCID—19986) Technical evaluation report on the monitoring of electric power to the reactor protection system for the Millstone Nuclear Power Station, Unit 1 (Docket No. 50-245).** Selan, J.C. (Lawrence Livermore National Lab., CA (USA)). 18 Jan 1984. Contract W-7405-ENG-48. 8p. NTIS, PC A02/MF A01. Order Number DE84006271.

This report documents the technical evaluation of the monitoring of electric power to the reactor protection system (RPS) at the Millstone Nuclear Power Station, Unit 1. The evaluation is to determine if the proposed design modification will protect the RPS from abnormal voltage and frequency conditions which could be supplied from the power supplies and will meet certain requirements set forth by the Nuclear Regulatory Commission. The pro-

posed design modifications will protect the RPS sustained abnormal voltage and frequency conditions from the supplying sources.

12076 **Modeling fragmentation and spallation of oxide reactor fuel during transient heating including the effects of burnup and fission product distribution.** Dimelfi, R.J.; Kramer, J.M. (Argonne National Laboratory, Reactor Analysis and Safety Division, 9700 South Cass Avenue, Argonne, Illinois 60439). *Nuclear Technology;* **62**: No. 1, 51-61(Jul 1983).

Characteristics of solid fuel fragmentation and energetic spallation during hypothetical accident transients are calculated. Fission gas, having migrated to the grain boundaries as intergranular bubbles, is assumed to provide the potential energy sufficient to fracture the fuel and induce fuel particle motion radially. Fuel-cladding is assumed to maintain a radial constraint on the fuel until the cladding fails by melting. It is shown that the vapor pressure of elemental cesium contained in the fuel-cladding gap can impose a compressive stress on the fuel sufficient to maintain a large quantity of intergranular fission gas trapped within equilibrium bubbles. On cladding melting and relaxation of constraint, the extent of fuel fracture initiated at the overpressured bubbles is calculated. It is shown that expanding fission gas in the fractured grain boundaries is sufficient to eject fuel particles at substantial velocities. The results of calculations are consistent with experimental observations.

12077 **An analytical study of a small-break loss-of-coolant accident with upper head injection.** Leonard, M.T. (EG & G Idaho, Inc., P.O. Box 1625, Idaho Falls, Idaho 83401). *Nuclear Technology;* **62**: No. 1, 31-42(Jul 1983). Contract AC07-76ID01570.

Upper head injection (UHI) is an emergency core coolant (ECC) system design that injects subcooled water into the upper head of the reactor vessel in a pressurized water reactor. An analysis has been performed that investigates the effects of UHI on small-break transient behavior. The analysis consists of several RELAP5/MOD1 computer code calculations, which have been compared to experimental data from a series of small-break loss-of-coolant accident simulations, performed in the Semiscale Mod-2A system. Small-break transient phenomena were calculated not to be significantly affected by the introduction of subcooled liquid into the vessel upper head. Nonequilibrium effects were minimal and limited to the period of ECC injection. The analysis covered a range of small-break sizes, and the severity of the transients (in terms of minimum core coolant level) was calculated to be a maximum (with or without UHI) for a cold leg break size of about 5.0% of the cold flow area. For all break sizes, UHI was calculated to increase the margin against core uncovery. The calculated hydraulic phenomena and specific fluid conditions were generally in good agreement with data. The calculated relative magnitudes of important phenomena were preserved over the break size spectrum.

12078 **6. status report of the HDR safety programme project of Karlsruhe Nuclear Research Centre, December 2, 1982. PHDR report 05.12/82.** Katzenmeier, G. (comp.). Karlsruhe, Germany, F.R.; Kernforschungszentrum Karlsruhe G.m.b.H. (1982). 472p. (In German). (CONF-821250—).

From Seminar on reactor technology; Karlsruhe, F.R. Germany (2 Dec 1982).

The HDR-safety programme deals with the verification of test- and design techniques by means of realistic integral tests. Picture 1 gives a view over the components and load cases which have been investigated as part of the HDR-safety programme. The codes and non-destructive test techniques used as part of the HDR-verification are listed. Separate abstracts were prepared for 13 papers in this report.

12079 **Verification of calculation methods.** Scholl, K.H.; Katzenmeier, G.; Malcher; Mueller-Dietsche. pp 35-59 of 6. status report of the HDR safety programme project of Karlsruhe Nuclear Research Centre, December 2, 1982. PHDR report 05.12/82. Katzenmeier, G. (comp.). Karlsruhe, Germany, F.R.; Kernforschungszentrum Karlsruhe G.m.b.H. (1982). (In German)(CONF-821250—).

From Seminar on reactor technology; Karlsruhe, F.R. Germany (2 Dec 1982).

The verification of calculation methods is the central PHDR-project task. It is a task common to all sub-projects of the HDR-safety programme - with the exception of EV 1000 and 5000, which are about the qualification of test techniques ; it has corresponding features and an according way of proceeding. The project work is directed towards obtaining results in a form which allows the direct application and use in practice (i.e. for design, licensing and safety assessment of nuclear power plant components). The conception and method of proceeding to achieve these objectives are presented.

12080 **EV 3000: Conception, objectives, status.** Scholl, K.H. pp 61-74 of 6. status report of the HDR safety programme project of Karlsruhe Nuclear Research Centre, December 2, 1982. PHDR report 05.12/82. Katzenmeier, G. (comp.). Karlsruhe, Germany, F.R.; Kernforschungszentrum Karlsruhe G.m.b.H. (1982). (In German)(CONF-821250—).

From Seminar on reactor technology; Karlsruhe, F.R. Germany (2 Dec 1982).

The investigations of the subproject 3000 concern the fluid dynamics during blowdown after a loss of coolant incident. In the case of the coupled fluid-structure-dynamic methods for reactor pressure vessel components also the structure reaction is calculated. The fluid-dynamics calculations form the beginning of the calculation chain. The load function during the blowdown incident is the result of the calculations. The components considered in EV 3000 are: - original safety fittings, i.e. steam insulation valve and feedwater return valve - pressure vessel components, i.e. the core shroud and - the reactor building with its safety containment.

12081 **Practical application of the findings of blowdown experiments with a feedwater return valve.** Slegers; Woelk (Kraftwerk Union A.G., Offenbach am Main (Germany, F.R.)). pp 75-126 of 6. status report of the HDR safety programme project of Karlsruhe Nuclear Research Centre, December 2, 1982. PHDR report 05.12/82. Katzenmeier, G. (comp.). Karlsruhe, Germany, F.R.; Kernforschungszentrum Karlsruhe G.m.b.H. (1982). (In German)(CONF-821250—).

From Seminar on reactor technology; Karlsruhe, F.R. Germany (2 Dec 1982).

The behaviour of the feedwater return valve SRV has been experimentally investigated under blowdown conditions in the HDR test facility as part of a contract between KfK-PHDR and the KWU. Former statistical statements and reports have already informed about this work. This report shall present the resumed results and final considerations for the thermohydraulic aspects of the project. The following paragraph 2b briefly considers the structure-dynamic analysis. The safety task of the SRV in the feedwater system is to minimize the return flow in plant transients and for assumed pipe rupture. Thereby the stress on the pipe line caused by the pressure shocks during closing has to be kept low. The aim of these investigations was to produce the evidence for the safe closing in a assumed rupture, to investigate the behaviour of the damped return valve by means of measuring and to determine the resulting stress on the line.

12082 **Practical application of the results of blowdown experiments with a feedwater return valve.** Habip, L.M.; Hess, J.; Widuch, L. (Kraftwerk Union A.G., Offenbach am Main (Germany, F.R.)). pp 127-140 of 6. status report of the HDR safety programme project of Karlsruhe Nuclear Research Centre, December 2, 1982. PHDR report 05.12/82. Katzenmeier, G. (comp.). Karlsruhe, Germany, F.R.; Kernforschungszentrum Karlsruhe G.m.b.H. (1982). (In German)(CONF-821250—).

From Seminar on reactor technology; Karlsruhe, F.R. Germany (2 Dec 1982).

In the HDR-SRV 350 blowdown tests (phase I) the structure-dynamic reaction of the feedwater line caused by the shock waves developing in the simulated pipe rupture by the rupture itself and the closing with the return valve with different degrees of valve damping has been measured. Comparisons of the results obtained by calculations and measurements (displacements, tensions/extensions) which have been made to judge the quality of the mathematical model and -program used (KWUROHR, ANSYS), and a brief evaluation of the calculated and measured fluid-dynamic pres-

sure shock-loads are already available. In the following the main results of these investigations and their application already effected in practice shall be resumed. A detailed description of the test procedure is not given.

12083 **Parameters influencing pressure vessel internals during blowdown.** Wolf, L. (Battelle-Institut e.V., Frankfurt am Main (Germany, F.R.)). pp 141-193 of 6. status report of the HDR safety programme project of Karlsruhe Nuclear Research Centre, December 2, 1982. PHDR report 05.12/82. Katzenmeier, G. (comp.). Karlsruhe, Germany, F.R.; Kernforschungszentrum Karlsruhe G.m.b.H. (1982). (In German)(CONF-821250—).

From Seminar on reactor technology; Karlsruhe, F.R. Germany (2 Dec 1982).

The report gives a view over the thermodynamic starting conditions of the four main experiments. From this information, the following four fields of the problem can be read as investigation aims: Reproducibility; later confirmation of the tests V31.0 and V31.1; linking of the main test series to the preliminary test series. German standard problem No. 5: increase of the fluid subcooling in the rupture socket and annular space. Reduction of the area of cross section of the rupture to 25% with the other starting conditions remaining equal to V32. Isothermal starting conditions; axial and radial play of flange to bearing with resulting axial and radial stops of the core shroud.

12084 **Experimental modal analysis of the HDR model tank.** Eberle, F.; Kadlec, J. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung). pp 195-208 of 6. status report of the HDR safety programme project of Karlsruhe Nuclear Research Centre, December 2, 1982. PHDR report 05.12/82. Katzenmeier, G. (comp.). Karlsruhe, Germany, F.R.; Kernforschungszentrum Karlsruhe G.m.b.H. (1982). (In German)(CONF-821250—).

From Seminar on reactor technology; Karlsruhe, F.R. Germany (2 Dec 1982).

The model-analytical experiments have been realized in two stages on the model core containment provided with according instrumentation. In the first stage (summer 1980) a total of 13 snapback-tests V59.1.2-V59.4.3 have been carried out with different parameters (RPV empty or filled with water, system pressure up to approx. 20 bar, system temperature approx. 20°C); The respective results of the modal-analytical evaluation have been summarized. In the second stage (spring 1982) immediately before the blowdown test V31.2, V32 and V33 one snapback-test each has been added carried out under the starting conditions of the given blowdown test (RPV filled with water, system pressure up to approx. 110 bar, system temperature up to approx. 310°C). The snapback-test V59.05 (pre-test of the blowdown test V32) of that second test series has been evaluated by modal analysis; the results obtained have been summarized and compared with the respective results of the first stage.

12085 **Verification of the code K-FIX on the basis of HDR-reactor pressure vessel internal experiments.** Travis, J.R. (Los Alamos National Lab., NM (USA)). pp 461-473 of 6. status report of the HDR safety programme project of Karlsruhe Nuclear Research Centre, December 2, 1982. PHDR report 05.12/82. Katzenmeier, G. (comp.). Karlsruhe, Germany, F.R.; Kernforschungszentrum Karlsruhe G.m.b.H. (1982). (CONF-821250—).

From Seminar on reactor technology; Karlsruhe, F.R. Germany (2 Dec 1982).

The coupled fluid-structure dynamics of a pressurized water reactor core support barrel can be accurately calculated with the K-FIX(3D, FLX) computer code for blowdown transients. The K-FIX solution method has been used to perform blind calculation analysis for German Standard Problem Number 5, a full scale blowdown test at the HDR facility in Kahl, West Germany.

12086 **Preliminary results of steam blowdown experiments inside the containment.** Risse; Huettermann (Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Koeln (Germany, F.R.)); Valencia, L. pp 211-229 of 6. status report of the HDR safety programme project of Karlsruhe Nuclear Research Centre, December 2, 1982. PHDR report 05.12/82. Katzenmeier, G. (comp.). Karlsruhe, Germany, F.R.; Kernforschungszentrum Karlsruhe G.m.b.H. (1982). (In German)(CONF-821250—).

From Seminar on reactor technology; Karlsruhe, F.R. Germany (2 Dec 1982).

The present phase I of the research project HDR (RS 123) is for the present forming the termination of a range of experimental investigations on the thermo- and fluid-dynamic behaviour of safety containments during loss of coolant incidents. These include also investigations on the open jet behaviour by means of an instrumented impact plate. The tests are used to confirm the applicability of the mathematical models developed for simulation of incidents in nuclear power plants.

12087 **EV 1000/2000: Conception, objectives, status.** Katzenmeier, G. pp 231-253 of 6. status report of the HDR safety programme project of Karlsruhe Nuclear Research Centre, December 2, 1982. PHDR report 05.12/82. Katzenmeier, G. (comp.). Karlsruhe, Germany, F.R.; Kernforschungszentrum Karlsruhe G.m.b.H. (1982). (In German)(CONF-821250—).

From Seminar on reactor technology; Karlsruhe, F.R. Germany (2 Dec 1982).

The HDR-programme has so far investigated stress conditions and, after weakening of component parts, failure developments on the RPV and pipe lines in the following load cases: - pressure tests, pressure tests (warm) - thermo-shock for restriction of 'realistic' transient loads and incident loads within the RN - blowdown, earthquake (auxiliary to EV 3000/4000).

12088 **Loads on the pressure vessel during normal operation and in case of accident.** Kussmaul; Jansky; Stegmeyer; Pfeffer (Staatliche Materialpruefungsanstalt, Stuttgart (Germany, F.R.)). pp 255-286 of 6. status report of the HDR safety programme project of Karlsruhe Nuclear Research Centre, December 2, 1982. PHDR report 05.12/82. Katzenmeier, G. (comp.). Karlsruhe, Germany, F.R.; Kernforschungszentrum Karlsruhe G.m.b.H. (1982). (In German)(CONF-821250—).

From Seminar on reactor technology; Karlsruhe, F.R. Germany (2 Dec 1982).

In the first phase of the HDR-programme investigations for determination of the stress under operational conditions (pressure test - warm) and test conditions (pressure test - cold) or under blowdown conditions (1F-ruptures on steam side or water side) with and without closing fittings have been carried out in the main. Moreover, the maximum possible stress in the area of a socket during a 'pressurized thermal shock' has been simulated. The stresses developing in the various load stages have been determined both by experimental (experimental tension analyses) and theoretical (by means of FE-calculation) investigations. In order to obtain information about the reliability of the analytical methods which are applied today for the layout, the results obtained by these investigations have always been compared.

12089 **Containment response and load during blowdown experiments.** Doltsinis; Jansky (Staatliche Materialpruefungsanstalt, Stuttgart (Germany, F.R.)). pp 287-323 of 6. status report of the HDR safety programme project of Karlsruhe Nuclear Research Centre, December 2, 1982. PHDR report 05.12/82. Katzenmeier, G. (comp.). Karlsruhe, Germany, F.R.; Kernforschungszentrum Karlsruhe G.m.b.H. (1982). (In German)(CONF-821250—).

From Seminar on reactor technology; Karlsruhe, F.R. Germany (2 Dec 1982).

In the blowdown tests V29.2 and V62.2 studied here after the reaction of the containment to sudden pressure release and the developing temperature differences were analyzed by means of the extension measurements on the containment steel shell carried out by the MPA-Stuttgart. The resulting strains allow the safety of the

steel shell to failure during blowdown to be evaluated quantitatively. In order to determine the differences between a blowdown of the live steach line (discharge of steam) and the feedwater line (discharge of water and steam) to the load of the containment steel shell, the results of both tests are compared with one another.

12090 **EV 4000: Conception, objectives, status.** Malcher; Jehlicka. pp 325-341 of 6. status report of the HDR safety programme project of Karlsruhe Nuclear Research Centre, December 2, 1982. PHDR report 05.12/82. Katzenmeier, G. (comp.). Karlsruhe, Germany, F.R.; Kernforschungszentrum Karlsruhe G.m.b.H. (1982). (In German)(CONF-821250—).

From Seminar on reactor technology; Karlsruhe, F.R. Germany (2 Dec 1982).

In the HDR-earthquake investigations the concussions to be expected from earthquakes are determined by calculation based on the following fundamental principles by using site-specific soil response spectra and experimentally obtained soil characteristic values: - Assumption of linear-elastic structure behaviour for constructional and machine systems - Use of model representations of different discreting (FE-models - 1-mass oscillator) - Assumption of given global dampings according to structures and type of earthquake - Use of separately determined, flattened building level spectra as excitation values for the structure-dynamic calculation of machine- and electronic technique - Calculation of the dynamic loads by .. time history methods .. response spectrum methods .. simplified methods.

12091 **Influence of supports/boundary conditions, studied for the example of a pipeline system.** Waldner. pp 343-373 of 6. status report of the HDR safety programme project of Karlsruhe Nuclear Research Centre, December 2, 1982. PHDR report 05.12/82. Katzenmeier, G. (comp.). Karlsruhe, Germany, F.R.; Kernforschungszentrum Karlsruhe G.m.b.H. (1982). (In German)(CONF-821250—).

From Seminar on reactor technology; Karlsruhe, F.R. Germany (2 Dec 1982).

The vibrational behaviour and the strain of the primary steam line PDL and recirculation loop URL of the HDR- plant in Kahl have been measured with three different ways of excitation and pre-calculated by three institutions. The general objective of the investigations is the verification of the test- and lay out methods by comparing measuring- and calculation results. This contribution deals in the PDL-system with the influence of the bearing of the rollector (connection of the PDL) and the stop point in the area of the constant hangers KH 511, and in the URL-system with the influence of the vibration absorbers on the URL by using as a basis the snapback investigations (high excitation).

12092 **Possibilities of decoupled calculation of machine components under investigation.** Jehlicka; Frick; Platz. pp 375-420 of 6. status report of the HDR safety programme project of Karlsruhe Nuclear Research Centre, December 2, 1982. PHDR report 05.12/82. Katzenmeier, G. (comp.). Karlsruhe, Germany, F.R.; Kernforschungszentrum Karlsruhe G.m.b.H. (1982). (In German)(CONF-821250—).

From Seminar on reactor technology; Karlsruhe, F.R. Germany (2 Dec 1982).

The seismic design of nuclear power plants requires dynamic calculations for which, strictly speaking, the total power plants (i.e. building with soil structures, containment, containment components, pipe line systems, components) represent a large vibrational system. The present report discusses some topics of the field of dynamic coupling and the influencing parameters. A brief review is given over the state of the art with regard to the decoupling of subsystems and - also with regard to the investigations to be carried out here - a proposal is made for a systematics to analyze the vibrational conditions of interconnected substructures. By selected examples of the detail analysis concerning the HDR-earthquake investigations the vibrational conditions of some interconnected structures are explained. Furthermore, a summary is given of the investigation results concerning the vibrational conditions of HDR-structures which have been obtained so far.

12093 **Experimental and theoretical determination of soil-structure interactions of the HDR building.** Wassermann (Battelle-Institut e.V., Frankfurt am Main (Germany, F.R.)); Waas (Hochtief A.G. fuer Hoch- und Tiefbauten, Frankfurt am Main (Germany, F.R.)). pp 421-458 of 6. status report of the HDR safety programme project of Karlsruhe Nuclear Research Centre, December 2, 1982. PHDR report 05.12/82. Katzenmeier, G. (comp.). Karlsruhe, Germany, F.R.; Kernforschungszentrum Karlsruhe G.m.b.H. (1982). (In German)(CONF-821250—).

From Seminar on reactor technology; Karlsruhe, F.R. Germany (2 Dec 1982).

The overall objective of the subproject EV 4000 is to find out how reliably the vibrational behaviour of the HDR in all its complexity (including components, connections to adjacent buildings etc.) can be determined by calculation if the building ground is moving as in earthquakes. The comparison of the test results with the calculation results shall reveal eventual weak points of the calculation methods (and also of the experimental technique) and if necessary contribute to improving the calculation methods. This report deals with the subproblem of ground-building interaction.

25 ENERGY STORAGE

2502 Compressed Gas

12094 **Optimizing the performance of compressed air energy storage (CAES) compressor and turbine trains.** Marinacci, D.J.; Bonk, J.S.; Bumgarner, J.M.; Schainker, R.B. (Westinghouse Electric Corp., Combustion Turbine Systems Division, Concordville, PA). *American Society of Mechanical Engineers,* [*Paper*]; **82-JPGC-GT-13**: 8(1982). (CONF-821018—).

From IEEE/ASME/ASCE joint power generation conference; Denver, CO, USA (17 Oct 1982).

This paper is a result of work done by the Westinghouse Electric Corporation on a $1.8 million, 3 1/2 year study funded by DOE and EPRI. The potential future market for Compressed Air Energy Storage (CAES) system is substantial. The savings realized by utilizing CAES power plants can be very attractive with the proper generation mix. The thermodynamic parametric performance studies that were conducted to screen the various aquifer charging and discharging cycles are discussed. Equations are presented to directly calculate the optimum (minimum required total compressor work and air cooler heat rejection) intercooler(s) location for a compressor train utilizing one and two intercoolers. An equation is also presented which directly determines the reheat combustor location required to maximize the turbine train output. A discussion is included why the performance of CAES power cycles must be optimized by considering the total power production energy costs not on a basis of maximum turbine output power or heat rate. Hardware and economic considerations which lead to CAES LP turbomachinery component standardization are discussed. Such standardization allows a manufacturer to economically adapt its CAES turbomachinery to a range of different air storage pressures.

2504 Capacitor Banks

12095 **(LA-UR—83-3634) Test techniques for model development of repetitive service energy storage capacitors.** Thompson, M.C.; Mauldin, G.H. (Los Alamos National Lab., NM (USA); Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract W-7405-ENG-36. 8p. (CONF-840367—1). NTIS, PC A02/MF A01. Order Number DE84004312.

From 4. capacitor and resistor technology symposium (CARTS '84); Orlando, FL, USA (6 Mar 1984).

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Advanced development in repetitive pulse capacitor technology has produced new testing requirements that include high-average power modulator test platforms and developed instrumentation. The Capacitor Test Facility at Los Alamos has been used to evaluate the performance of the Sandia perfluorocarbon family of energy

storage capacitors. These perfluorocarbon-impregnated capacitors have, in fact, provided us with a new window into highly sophisticated thermal and electrochemical mechanisms. These capacitors have a much lower charge noise signature creating new instrumentation performance goals. Thermal response to power loading and the importance of average and spot heating in the bulk regions require technical advancements in real-time temperature measurements. Reduction and interpretation of thermal data are crucial to the accurate development of an intelligent thermal transport model. The thermal model is of prime interest in the high repetition rate, high-average power applications of power conditioning capacitors. The accurate identification of device parasitic parameters has ramifications in both the average power loss mechanisms and peak current delivery. Methods to determine these parasitic characteristics and their nonlinearities and terminal effects are part of the overall performance considerations. The main thrust of our work is making meaningful interpretations for model development. We will discuss performance history, facility development, instrumentation, and plans for the future, as well as present data.

2505 Flywheels

12096 **(AD-P—001729/3) Analysis of containment rings for flywheel burst protection.** Bert, C.W. (Oklahoma Univ., Norman (USA). School of Aerospace, Mechanical and Nuclear Engineering). May 1983. 5p. NTIS, PC A02/MF A01.

This paper is concerned with the analysis of Hertzian impact of a band-supported, thick-rim flywheel against an elastic containment ring. The following topics are addressed: consideration of probable failure mode of the flywheel, estimation of impact velocity, prediction of maximum conditions at contact, prediction of the maximum bending stress in the impulsively loaded containment ring, and sample calculation for a proposed containment ring.

12097 **(UCRL—53448) Flywheel rotor and containment technology development. Final report.** Mohr, P.B.; Walter, C.E. (Lawrence Livermore National Lab., CA (USA)). 19 Sep 1983. Contract W-7405-ENG-48. 92p. NTIS, PC A05/MF A01. Order Number DE84005742.

A program to develop energy storage systems based on high-performance flywheels, which has been carried on by LLNL under DOE sponsorship since 1975, has been terminated with the 1983 fiscal year. This final report summarizes the accomplishments of that program, with emphasis on the work of the terminal year and orderly closeout of the program. Activities of the terminal year included fabrication, quality assurance inspection, and spin-test evaluation of rotor and containment structures. Peak stored energies approaching 0.7 kWh were consistently attained in 10-kg rotors, yielding material-average stored energy densities exceeding 70 Wh/kg. Flywheel rotors were tested by cycling them between full design speed and half speed for 10,000 cycles without rotor failure. The initial test of a lightweight containment structure indicated need for a better understanding of the rotor failure process and for additional development. In complementary studies, production cost estimates were made for three flywheel designs. In a cooperative program with the University of Wisconsin, construction began on a second-generation hybrid automobile combining a flywheel, a continuously variable transmission, and a conventional heat engine - a combination which promises fuel economy improvements up to 100% in urban use. Suggestions are made for direction of future work when interest in flywheel systems reappears.

2506 Thermal

REFER ALSO TO CITATION(S) 11804, 12536

12098 **(NYSERDA—83-22) Olympic Village thermal energy storage experiment. Final report.** Fernandes, R.A.; Saylor, C.M. (Niagara Mohawk Power Corp., Syracuse, NY (USA); Systems Control, Inc., Palo Alto, CA (USA)). Apr 1983. Contract W-7405-ENG-26. 217p. NTIS, PC A10/MF A01. Order Number DE84005672.

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Four thermal energy storage (TES) systems were operated in identical dormitory-style buildings of the Raybrook Correctional Facility, formerly the housing for the athletes at the 1980 Winter Olympic Games in Lake Placid, New York. The objectives of the project were to assess the ability of these TES systems to be controlled so as to modify load profiles favorably, and to assess the ability to maintain comfortable indoor conditions under those control strategies. Accordingly, the test was designed to evaluate the effect on load profiles of appropriate control algorithms for the TES systems, collect comprehensive TES operating data, and identify needed research and development to improve the effectiveness of the TES systems. The four similar dormitory buildings were used to compare electric slab heating on grade, ceramic brick storage heating, pressurized-hot-water heating, and heat pumps with hot-water storage. In a fifth similar building, a conventional (non-TES) forced air electric resistance heat system was used. The four buildings with TES systems also had electric resistance heating for backup. A remote computer-based monitoring and control system was used to implement the control algorithms and to collect data from the site. For a 25% TES saturation of electric heat customers on the NMPC system, production costs were reduced by up to $2,235,000 for the New York Power Pool. The winter peak load was reduced by up to 223 MW. The control schedules developed were successful in reducing on-peak energy consumption while maintaining indoor conditions as close to the comfort level as possible considering the test environment.

12099 **(PNL—4929) Relationship of regional water quality to aquifer thermal energy storage.** Allen, R.D. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1983. Contract AC06-76RL01830. 463p. NTIS, PC A20/MF A01. Order Number DE84006267.

Ground-water quality and associated geologic characteristics may affect the feasibility of aquifer thermal energy storage (ATES) system development in any hydrologic region. This study sought to determine the relationship between ground-water quality parameters and the regional potential for ATES system development. Information was collected from available literature to identify chemical and physical mechanisms that could adversely affect an ATES system. Appropriate beneficiation techniques to counter these potential geochemical and lithologic problems were also identified through the literature search. Regional hydrology summaries and other sources were used in reviewing aquifers of 19 drainage regions in the US to determine generic geochemical characteristics for analysis. Numerical modeling techniques were used to perform geochemical analyses of water quality from 67 selected aquifers. Candidate water resources regions were then identified for exploration and development of ATES. This study identified six principal mechanisms by which ATES reservoir permeability may be impaired: (1) particulate plugging, (2) chemical precipitation, (3) liquid-solid reactions, (4) formation disaggregation, (5) oxidation reactions, and (6) biological activity. Specific proven countermeasures to reduce or eliminate these effects were found. Of the hydrologic regions reviewed, 10 were identified as having the characteristics necessary for ATES development: (1) Mid-Atlantic, (2) South-Atlantic Gulf, (3) Ohio, (4) Upper Mississippi, (5) Lower Mississippi, (6) Souris-Red-Rainy, (7) Missouri Basin, (8) Arkansas-White-Red, (9) Texas-Gulf, and (10) California.

2509 Batteries

REFER ALSO TO CITATION(S) 12536

12100 **(AD-A—132279/1) Safety studies on Li/$SOCl_2$ reserve battery. Final report 30 sep 81-30 mar 83.** Doddapaneni, N. (Honeywell, Inc., Horsham, PA (USA). Power Sources Center). May 1983. 108p. NTIS, PC A06/MF A01.

The effects of cell design and metal-phthalocyanine catalysts on the safety of Li/S0C12 reserve cells were evaluated. Cathode-limited design cells either vented or exploded during forced overdischarge. Both forced overdischarge current density, and overdischarge time into reversal influenced the cell failure unpredictably. Anode-limited design cells, on the other hand, generated severe internal heat during reversal, but sustained higher forced overdischarge current densities than cathode-limited design cells without either venting or exploding. When the 1.5M $LiAlCl_4/S0Cl_2$ was replaced with 1.5M $LiAlCl_4/S0_2Cl_2$ electrolyte in the cathode-limited

design cells, both the cell discharge life and cell safety improved. The catalyst stability and stainless stel (bellow material) compatibility were also studied in both neutral and acidic electrolytes. The catalyst was found to be stable and the stainless steel specimens (316L and 321) experienced only surface corrosion after 12-month storage. The surface film formed during the initial surface corrosion appeared to inhibit further corrosion. Heat cool cycles between -40 and 71 C of fresh cells and partially or fully discharged D-cells did not adversely influence the cell pressure at the end of 100% depth of discharge.

12101 **(CONF-8310241—2) Post-test analysis of positive electrodes from CSPL Beta cells.** Battles, J.E. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 14p. NTIS, PC A02/MF A01. Order Number DE84005216.

From DOE/EPRI beta battery workshop; Washington, DC, USA (18 Oct 1983).

The post-test examinations conducted on Beta (sodium/sulfur) cells designed for electric-vehicle applications are described. These cells utilized the sulfur core concept and were tested in a horizontal position. The major emphasis of these examinations was to determine: (1) the corrosion of current-collector materials and the associated transport and distribution of corrosion products, (2) the morphology of the sulfur electrode, i.e., microstructure, distribution of sulfur/soldium polysulfide phases, concentration and distribution of voids, and uniformity of the charge/discharge reactions, (3) the identity and extent of reactions with the materials in the glass and thermocompression bond seals, and (4) evidence of degradation of the β''-Al_2O_3 electrolyte. The latter two items are not covered here.

12102 **(DOE/CS/84062—1) Silver-silver chloride thermocells and thermal liquid junction potentials for sodium chloride solutions at elevated temperatures.** Hwang, L.S.; Boateng, A.; Macdonald, D.D. (Ohio State Univ., Columbus (USA). Dept. of Metallurgical Engineering). 1981. Contract FG02-80CS84062. 10p. (CONF-811013—26). NTIS, PC A02/MF A01. Order Number DE84005248.

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

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Potentials for the thermocell (298.15°K) Ag-AgCl/NaCl/AgCl-Ag(T°K) have been determined for NaCl concentrations ranging from 0.005 to 0.5 mol/Kg and for temperatures as high as 548.15°K. Thermodynamic analysis of the cell has permitted evaluation of the initial state thermal liquid junction potentials (Δphi/sub TLJP/) over the same range of conditions, and it was found that Δphi/sub TLJP/ increases in an approximately parabolic manner with ΔT(=T-298.15°K). The entropy of transport function t/sub +/S*/sub NA/sup +// - t /sub -/S*/sub Cl/sup -// has also been calculated.

12103 **(LBL—16850) Electrochemistry of the sulfide/polysulfide couple. Final report, November 1, 1082-June 30, 1983.** Remick, R.J.; Camara, E.H. (Institute of Gas Technology, Chicago, IL (USA)). Jul 1983. Contract AC03-76SF00098. 43p. NTIS, PC A03/MF A01. Order Number DE84005881.

The redox behavior of solutions containing sodium sulfide and sodium polysulfide was investigated using a platinum wire electrode. We determined that, contrary to published literature, the equilibrium potential of the sulfide/polysulfide redox does have a pH-sensitive component. Experimental results indicate that platinum is not a good electrocatalyst for this couple, but that upon anodization a layer is formed on the surface of the platinum that imparts a reasonable catalytic activity to the electrode. A mechanism is proposed based on present results and past literature that accounts for most if not all of the observed phenomenon. This proposed mechanism predicts that electronically conducting materials that contain sulfur as part of their chemical composition, specifically CoS, NiS, CuS, PbS, and MoS_2, should be excellent electrocatalysts for both anodic and cathodic reactions. This was confirmed for CoS, CuS, and PbS previously. This present work extends the range of materials investigated to include NiS and MoS_2 and two alternative methods for preparing sulfide electrodes. Experimental results indicate that MoS_2 is the preferred electrocatalyst for the sulfide/polysulfide redox couple and that a relatively inexpensive composite electrode can be fabricated using 10% MoS_2, 80% carbon black, and 10% Teflon 30.

12104 **(SAND—83-1081) Compatibility and accelerated aging study for Li(Si)/FeS_2 thermally activated batteries.** Mead, J.W.; Searcy, J.Q.; Neiswander, P.N.; Poole, R.L. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1983. Contract AC04-76DP00789. 70p. NTIS, PC A04/MF A01. Order Number DE84006099.

Thermally activated batteries using the lithium(silicon) iron disulfide (Li(Si)/FeS_2) electrochemical system are used in weapons having a required storage life of 25 years and high reliability. A review of known data revealed no information on the compatibility of Li(Si)/FeS_2 with the organic materials used in the system. One phase of this study addressed the compatibility question; a second phase produced accelerated-aging data on pairs of materials. In addition, a group of production batteries was aged and tested. Three aging temperatures were used during the one-year study. Gas analyses, electrical tests and mechanical tests were compared for control and aged samples. Two results, the depletion of oxygen and an increase in hydrogen in the compatibility and accelerated-aging samples, have stimulated additional studies. No unexpected or significant changes were observed in the electrical or mechanical properties of the organic materials. Calorific output and chloride ion content of heat pellets indicated no degradation with aging. Ignition sensitivity and burn rate measurements suggested no heat pellet degradation. Oxygen content in aged lithium(silicon) anodes remained within acceptable limits. Single-cell tests and battery test results showed no degradation with aging.

12105 **(SAND—83-1523) Complex impedance of Ca/$CaCrO_4$/Fe thermal batteries.** Guidotti, R.A.; Delnick, F.M. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1983. Contract AC04-76DP00789. 16p. NTIS, PC A02/MF A01. Order Number DE84005507.

The frequency dispersion of the complex impedance of 5-cell Ca/$CaCrO_4$/Fe thermal batteries and related battery components was measured. The battery resistance was partitioned among its components (bulk DEB, interfacial reaction layers, and leads and intercell connectors) and the relative magnitudes determined. The ohmic and non-ohmic contributions to the battery voltage losses were evaluated. A possible mechanism for battery end of life is presented.

12106 **(SAND—83-2655C) ac conductivity of polycrystalline CA-β''-alumina.** Hellstrom, E.E. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 15p. (CONF-831086—11). NTIS, PC A02/MF A01. Order Number DE84005529.

From Electrochemical Society fall meeting; Washington, DC, USA (9 Oct 1983).

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Polycrystalline Ca-β''-alumina was prepared from Na-β''-alumina by molten salt exchange in $Ca(NO_3)_2$-$CaCl_2$ and in $CaCl_2$. $CaO.6Al_2O_3$ did not form during the exchange processes. $CaCl_2$ attacks the polycrystalline β''-alumina. ac conductivity data on the polycrystalline material were fitted to an equivalent circuit using a nonlinear least-squared-error fitting program, from which the Ca ion conductivity was extracted. The bulk Ca ion conductivity is 3×10^{-4} $(ohm.cm)^{-1}$ at 300°C. Intergranular resistance is thought to dominate the overall Ca ion resistance.

12107 **(SAND—83-7467C) Zinc-bromine cell design.** Bellows, R. (Exxon Research and Engineering Co., Linden, NJ (USA). Corporate Research-Technology Feasibility Center). 30 Nov 1983. Contract AC04-76DP00789. 25p. (CONF-8311134—1). NTIS MF A01. Order Number DE84005532.

From Workshop on the electrochemistry of zinc/halogen batteries; Palo Alto, CA, USA (30 Nov 1983).

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A set of slides is reproduced which illustrates the design of a zinc-bromine circulating battery. Low-cost manufacturing techniques and scale-up rationale are outlined, and design parameters are listed. Also outlined is a computer model of the zinc-bromine battery. (LEW)

12108 **Method of pretreating carbon black powder to improve cathode performance and lithium sulfuryl chloride cell including the pretreated carbon black powder.** Binder, M.; Walker, C.W. Jr; Petersen, E.R.; Wade, W.L. Jr; Gilman, S. US Patent Application 6-544,770. 24 Oct 1983. 10p.

Carbon black powder is pretreated with acetone or methanol prior to cathode fabrication to improve the cathode operating voltage and increase the cathode life of lithium sulfuryl chloride electrochemical cells.

12109 **Lead deficiency and hydrogen content in battery electrode β-PbO_2.** Jorgensen, J.D.; Cook, G.; Varma, R.; Yao, N.P. (Argonne National Laboratory, Solid State Science Division and Chemical Engineering Division, Argonne, Illinois). *Journal of the Electrochemical Society;* **129**: No. 8, 1678-1681(Aug 1982).

Neutron powder diffraction data have been collected for β-PbO_2 obtained from lead-acid battery plates cycled in H_2SO_4 and D_2SO_4. A comparison of total scattering cross sections for the hydrogenated sample vs. the deuterated sample indicates a bulk hydrogen concentration of 0.21 H atoms per PbO_2 unit. Rietveld refinements of the data yield the expected tetragonal β-PbO_2 structure, $P4_2/mnm$, with a 3-5% vacancy concentration on the lead sites. These results suggest that at least part of the hydrogen is incorporated into the β-PbO_2 crystalline lattice.

12110 **Integrated environmental and safety assessment of selected battery energy-storage systems.** Metwally, A.W.; Gray, W.S. (Bechtel Group, Inc., San Francisco, CA). pp 24-27 of Proceedings of the IASTED energy symposia: modelling, policy and economics of energy and power systems; alternative energy sources and technology. Hamza, M.H. (ed.). Anaheim, CA; ACTA Press (1981). (CONF-810574—).

From International Association of Science and Technology for Development energy symposium; San Francisco, CA, USA (20 May 1981).

Battery energy-storage systems are used to store off-peak energy from electric power plants for use at peak energy demand times. The use of such systems could help reduce the need for combustion turbines and contribute to the national objective of reducing oil imports. This Electric Power Research Institute (EPRI)-sponsored study was conducted by Bechtel to provide an integrated environmental and safety assessment of five battery energy-storage systems: lead-acid, zinc-chlorine, zinc-bromine, sodium-sulfur, and lithium-metal sulfide. The study also included the formulation of a methodology for selecting sites for battery energy-storage systems and design recommendations for mitigating environmental impacts. The study did not identify any significant environmental effects from the normal operation of the five battery energy-storage systems. Potential effects of accidents, disposal of hazardous waste, and battery manufacturing are concerns that should be considered in battery energy-storage system development. The availability of raw materials such as lead, calcium, aluminium, and lithium may affect the large-scale development of battery energy-storage systems. Existing manufacturing capacity and ability to expand may also affect the use of these systems. 15 references, 1 table.

12111 **Electrochemical cell.** Kaun, T.D. US Patent Application 6-440,203. [nd]. 25p. Contract W-31-109-ENG-38.

An improved secondary electrochemical cell is disclosed having a negative electrode of lithium aluminum, a positive electrode of iron sulfide, a molten electrolyte of lithium chloride and potassium chloride, and the combination that the fully charged theoretical capacity of the negative electrode is in the range of 0.5 to 1.0 that of the positive electrode. The cell thus is negative electrode limiting during discharge cycling. Preferably, the negative electrode contains therein, in the approximate range of 1 to 10 volume % of the electrode, an additive from the materials of graphitized carbon, aluminum-iron alloy, and/or magnesium oxide.

12112 **Chromium (V) compounds as cathode material in electrochemical power sources.** Delnick, F.M.; Guidotti, R.A.; McCarthy, D.K. US Patent Application 6-487,492. [nd]. 14p. Contract AC04-76DP00789.

A cathode for use in a thermal battery, comprising a chromium (V) compound. The preferred materials for this use are $Ca_5(CrO_4)_3Cl$, $Ca_5(CrO_4)OH$, and Cr_2O_5. The chromium (V) compound can be employed as a cathode material in ambient temperature batteries when blended with a suitably conductive filler, preferably carbon black.

29 ENERGY PLANNING AND POLICY

REFER ALSO TO CITATION(S) 12177

12113 **(GAO/OGC—83-11) [Impoundment Control Act requirements for reporting Strategic Petroleum Reserve funding deferral].** (General Accounting Office, Washington, DC (USA). Office of the Comptroller General). 5 May 1983. 5p. US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760.

This letter reports a deferral in budget authority provided for the Strategic Petroleum Reserve (SPR) petroleum account which should have been, but was not, reported to the Congress pursuant to the provisions of the Impoundment Control Act, 2 U.S.C.A. sections 681 et seq. The funds involved are used for petroleum acquisition, transportation, and injection activities for the SPR. A total of $4.5 billion is available in the SPR account for oil deliveries in fiscal year 1983. We estimate that, at current prices, approximately $800 million in the SPR account will remain unobligated in fiscal year 1983. Calculations based on current fill practices are enclosed.

12114 **(GAO/RCED—83-123) Triennial assessment of the Tennessee Valley Authority: Fiscal years 1980-1982.** Bowsher, C.A. (General Accounting Office, Washington, DC (USA). Office of the Comptroller General). 15 Apr 1983. 109p. US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760.

Report To The Congress.

This report summarizes GAO's work at the Tennessee Valley Authority (TVA) during the past 3 years. Because TVA is a federal corporation, GAO is required to report on TVA's status every 3 years. The report presents the progress TVA has made to comply with GAO's recommendations dealing with demand forecasting, internal audit, and acquisition of ADP resources. It also discusses information and data on TVA requested by the Congress. Overall, TVA has taken a positive approach in improving its operations.

12115 **(GAO/RCED—83-193) Status of various electric energy conservation programs, activities, and powerplant capacities in the United States.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 19 Sep 1983. 63p. US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760.

Report to the Chairman, Subcommittee on Energy Conservation and Power Committee on Energy and Commerce, House of Representatives.

The Chairman of the Subcommittee on Energy Conservation and Power, House Committee on Energy and Commerce, asked GAO to answer five specific questions on the status of electric energy-related efficiency activities in the United States. This report provides information on the status of federal, state, and utility energy-efficiency improvement programs. It also highlights the status and performance trends of domestic electricity-producing powerplants.

12116 **(GAO/RCED—84-13) Uranium enrichment deferral charges and the customer payment period.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 21 Oct 1983. 30p. US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760.

A Department of Energy (DOE) Office of the Inspector General report entitled Dollar Impact of Financial Management Decisions in the Uranium Enrichment Program includes two recommendations which, if implemented, would change the interest rate DOE uses to compute its charges to customers deferring delivery of uranium enrichment services and reduce the 30-day interest-free period customers are allowed for making payment on DOE-

provided enrichment serivces. GAO believes that an interest rate based on the current market yield on Treasury borrowings with maturities comparable to the period of deferrals (current-market-yield rate) better reflects the cost of Treasury borrowings and is therefore more appropriate than either the rate DOE currently uses or the rate recommended by DOE's Inspector General. DOE agrees and plans to use the current-market-yield rate in any deferral under future contracts. GAO also believes reducing the customer payment period has merit from a cash management standpoint. However, the effect of such an action on DOE's competitive position among foreign suppliers of enrichment services needs to be considered before any such reduction is made.

12117 **(GAO/RCED—84-15) Nuclear safety research responsiveness to regulatory needs and coordination.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 15 Nov 1983. 41p. US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760.

Report to the Honorable Marilyn Lloyd, Chairman, Subcommittee on Energy Research and Production Committee on Science and Technology, House of Representatives.

The Nuclear Regulatory Commission (NRC) spends about half of its budget, or about $210 million, on safety research to support nuclear facility licensing and regulation. The Department of Energy also conducts research and development of nuclear technologies being licensed and regulated by NRC. GAO found that NRC has not documented that its research has been responsive to its regulatory needs. NRC also recognized this problem and developed and began operating a system to periodically provide NRC management with oversight over its research projects. GAO also found that the coordinating techniques have helped keep DOE and NRC aware of each other's research efforts but that intentional duplication occasionally occurs due to the two agencies' different roles.

12118 **(GAO/RCED—84-18) Estimated effect of eliminating TVA electricity demand charges on the price of enriched uranium.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 11 Oct 1983. 8p. US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760.

An estimate of the price of enrichment services from fiscal years 1984 through 1995 are forecast assuming demand charges were eliminated and TVA power rates were set. Uranium enrichment program officials estimated the TVA power rate and TVA officials confirmed the reasonableness of that estimate.

12119 **(GAO/RCED—84-25) Policies governing Bonneville Power Administration's repayment of federal investment still need revision.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 26 Oct 1983. 29p. US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760.

Report to The Secretary of Energy.

The federal government, through the Bonneville Power Administration, has invested over $7 billion in hydroelectric facilities in the Federal Columbia River Power System. Through 1964, Bonneville repaid the federal investment using fixed annual repayments. However, in 1965, Bonneville dropped fixed annual repayments and adopted the repayment study method for determining revenue requirements. The repayment study is designed to produce revenues to pay costs, including repayment of the federal investment. The only requirement is that the projects be repaid within their scheduled life. The federal investment, however, is the lowest category of expense; therefore, if revenues are insufficient to cover all expenses, the federal investment is deferred. In the past 6 years Bonneville has experienced operating losses, resulting in nonpayment of the federal investment. As in 1981, GAO reports that Bonneville's repayment study method is inadequate and recommends a fixed/mortgage basis with required annual repayments. (PSB)

12120 **(GAO/RCED—84-32) Circumstances surrounding the First Colony peat-to-methanol project.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 10 Nov 1983. 28p. US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760.

Report to The Chairman, Subcommittee on Oversight and Investigations, Committee on Energy and Commerce, House of Representatives.

On December 13, 1982, the Chairman of the US Synthetic Fuels Corporation signed a letter of intent to favorably recommend to the Board of Directors the initial award of up to $465 million in loan and price guarantees for a project to produce 60 million gallons per year of methanol fuel from North Carolina peat lands. The project is scheduled to start production by December 1986 and will be situated on a 15,000 acre tract of peat land near Creswell, North Carolina. GAO addresses questions regarding this project, including the legal authority for the letter of intent. Corporation staff recommendations against federal backing of the project, specific criticisms of the project by North Carolina environmentalists, and the justification for the project's receiving Corporation price guarantees.

12121 **(GAO/RCED—84-39) DOE should strengthen its controls over award fees to contractors.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 22 Nov 1983. 20p. US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760.

Report to The Secretary of Energy.

The Department of Energy hires contractors to run its government-owned, energy- and defense-related research and production facilities. DOE furnishes the plants and equipment, pays employee salaries, and provides the contractors with working capital through letters of credit. Most contractors also receive a fee for their services. DOE favors using award-fee contracts, where the fee amount partially depends on the quality of the contractor's performance. In 1982, six DOE field offices administered 25 award-fee contracts totaling almost $2.8 billion and paid these contractors about $58 million in fees. GAO concludes that DOE needs to improve its guidance and practices for calculating allowable fees. DOE also needs to expand its periodic reviews of field offices' procurement operations to include evaluations of how field offices are determining fee amounts.

12122 **(NP—4770158) Colombia - energy situation 1982.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Aug 1983. 15p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84770158.

A short survey is given of the energy situation of Colombia. After some remarks on the general development in the energy sector, the developments and programmes are described concerning petroleum, natural gas, coal, nuclear energy, hydropower, and electric power generation. Moreover, some important figures on foreign trade are given.

2901 Energy Analysis And Modeling

REFER ALSO TO CITATION(S) 11481, 11515, 11516, 11517, 11521, 11522, 11536, 11553, 11637, 12161

12123 **(ESC—23) Energy supply in four scenarios based on calculations with energy model SELPE.** Boonekamp, P.G.M.; Koenders, N.J.; van Oostvoorn, F. (Stichting Energieonderzoek Centrum Nederland, Petten). Jul 1983. 172p. (In Dutch). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84750756.

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Four energy scenarios, developed last two years in the Netherlands are: a Reference scenario (EZ), developed by the Ministry of Economic Affairs, which assumes a growth of GNP of circa 1.25% p.a.; a High-Growth scenario (IH), developed on act of the Steering Committee of the National Debate, based on a growth of GNP of circa 2.5% p.a.; a Low-Growth scenario (AD), developed on act of the same Committee, based on a growth of GNP of 1.5% p.a.; a Conservation (of energy and environment) scenario (CE), developed by the Stichting Economisch Onderzoek (SEO) and the Centrum voor Energiebesparing and a few other organizations, assuming a growth of GNP of 1.0% p.a. An overview is given of the different energy supply scenarios and their consequences in terms of fuel consumption, energy costs, investments, emission, energy

balance, electricity production and prices. It is a systematic overview because of the four supply scenarios are developed by the same model, a Linear Programming model (SELPE) developed at the Energy Study Centre. Some conclusions are: the production and consequently the consumption of natural gas decreases rapidly causing a serious deterioration of the energy balance of payments. Oil consumption is almost restricted to applications like feedstocks and transportation in 2000; the emission levels are lowest in the CE-scenario, but show a moderate rise in the other scenarios; the costs of the energy supply are rising in all scenarios. In the CE-scenario the lower energy consumption partly off-sets this effect; because of rising gas prices the governmental revenues are not decreasing as fast as natural gas consumption.

2902 Economics And Sociology

REFER ALSO TO CITATION(S) 11518, 11717, 11734, 11735, 12141, 12152, 12168, 12172, 12176, 12179, 12182, 12184, 12193, 12194, 12196, 12201, 12711

12124 **(CEGB-P—8(Vol.1and2)) Sizewell 'B' power station public inquiry: CEGB proof of evidence. Construction time, cost and operating performance of PWR, AGR, and coal-fired generating plant. Vol. 2. Diagrams, tables and appendices.** Wilson, A. (Central Electricity Generating Board, London (UK)). Nov 1982. 156p. NTIS (US Sales Only), PC A08/MF A01. Order Number DE83703917.

The methods of establishing construction time, capital cost, availability and lifetime of different types of generating plant are described. In volume one assessments are presented for a new coal fired station, for a new AGR station and for a new PWR station - Sizewell B. Volume two, contains all diagrams, tables and appendices presented as evidence.

12125 **(CONF-8109249—) Demands on the socialist labour sciences in coal and energy industry. Evaluation of the 10th party congress of the SED on rational utilization of working power.** (Ingenieurhochschule Zittau (German Democratic Republic)). 9 Nov 1981. 166p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84770092.

From 10. party congress of the SED on rational utilization of working power; Zittau, German D.R. (30 Sep 1981).

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60 representatives from science and industry exchanged experiences and results from their work at the colloquium. The results showed, in agreement with the participants, that the topic had been well suited for putting through important tasks and requirements of economic and social policy. In the 12 lectures, published in this proceedings volume the participants presented their own experiences in the realization of ergonomic tasks in coal and energy industry as well as problems and results of scientific work. Thus science and practical application had received manifold impulses from each other which have a fertilizing effect for further work.

12126 **(DOE/MI/10023—T2) Cooperative Development Energy Program. Quarterly report, October 1, 1983-December 30, 1983.** Smith, L.S.; Anthony, J.L.; Crawford, B. Jr.; Grissom, W.A.; Washington, W.J. (Central State Univ., Wilberforce, OH (USA). Dept. of Chemistry). [nd]. Contract FC01-83MI10023. 5p. NTIS, PC A02/MF A01. Order Number DE84005468.

Major barriers to the penetration of minorities and minority businesses in the energy field were found to be: a lack of investment capital, a lack of awareness of the community of the services and products of the minority businesses, a lack of the necessary marketing skills to be competitive, and a lack of awareness of the major industries of the resources and capabilities of the minority businesses. A plan of action is being developed for the project.

2903 Environment, Health, And Safety

REFER ALSO TO CITATION(S) 11443, 12123, 12205, 12696, 12743, 12744, 12747, 12751

12127 **(AD-A—130668/7) Installation restoration program records search for Bergstrom Air Force Base, Texas.** (CH2M Hill Southeast, Inc., Gainesville, FL (USA)). Jul 1983. 273p. NTIS, PC A12/MF A01.

Department of Defense (DoD) policy, directed by Defense Environmental Quality Program Policy Memorandum is to identify and fully evaluate suspected problems associated with past hazardous material disposal sites on DoD facilities, control the migration of hazardous contamination from such facilities, and control hazards to health and welfare that may have resulted from these past operations. The Bergstrom AFB records search included a detailed review of pertinent installation records, contacts with 12 government organizations for documents relevant to the records search effort. Activities conducted during the onsite base visit included interviews with 43 past and present base employees, gorund tours of base facilities, a detailed search of installation records, and a helicopter overflight to identify past disposal areas. No direct evidence was found to indicate that migration of hazardous contaminants exists within or beyond Bergstrom AFB boundaries.

12128 **(AD-A—130694/3) Users guide: simulation model for ammunition plants; prediction of wastewater characteristics and impact of reuse/recycle. Final report.** Railsback, S.; Messenger, M.; Webster, R.D.; Bandy, J.T. (Army Construction Engineering Research Lab., Champaign, IL (USA)). Jun 1983. 67p. (CERL-TR-N—152). NTIS, PC A04/MF A01.

This report describes the algorithm and details the operating instructions required for an ammunition plant process model developed for DARCOM environmental personnel. The model was created to define the impact of increased ammunition production on the quantity and quality of the effluents discharged from the plants. It also allows assessment of the impact of recycle/reuse of wastewaters on final effluent quality. This model may be accessed through the Environmental Technical Information System.

12129 **(DOE/ER—0186) CO_2 climate research plan.** Riches, M.R. (USDOE Office of Energy Research, Washington, DC. Office of Basic Energy Sciences). Dec 1983. 25p. NTIS, PC A02/MF A01. Order Number DE84005461.

The plan addresses the questions related to the global and regional rate of CO_2-induced climate change. The objective is to define the key questions in such a way that research is directed at experiments where answers are needed rather than at experiments where answers can be easily obtained. This research plan includes a short history of the effects of CO_2 on climate as studied, followed by a description of the structure of the CO_2-climate subsystem. The major part of the plan describes the research tasks within the subsystem. The final section of the plan addresses program priorities and scheduling.

12130 **(DOE/ER—0187) Vegetation response to carbon dioxide research plan.** Dahlman, R.C. (USDOE Office of Energy Research, Washington, DC. Office of Basic Energy Sciences). Jan 1984. 35p. NTIS, PC A03/MF A01. Order Number DE84006219.

The goal of the program is to acquire the knowledge base for addressing government policies related to effects of increasing atmospheric CO_2. This research plan identifies information needed to reduce uncertainties about crop and ecosystem responses to CO_2. This information will be used for balanced assessments of long-range environmental consequences of a higher CO_2 world. This research plan will develop the ability to predict crop and ecosystem responses to elevated levels of CO_2. Principal objectives are (a) to determine fundamental effects of long-term, elevated CO_2 exposure on plant physiology and growth; (b) to determine yield of major crops in relation to more CO_2; and (c) to evaluate ecosystem responses in terms of productivity, altered composition of plant communities and carbon change from CO_2 enhancement of growth. Integrated approaches for achieving the plan's objectives require ac-

quisition of laboratory and field data on the effects of CO_2 on plant physiology and growth. Simultaneously, models will be developed for predicting responses directly related to CO_2 as well as to the combined effects of CO_2 and other environmental variables affecting plant growth. Emphasis will be on field research when this approach holds promise for achieving objectives. Attaining an adequate database for scientific understanding is the first priority, followed by interpretations and assessments of economic benefits and costs to agriculture and of potential impacts on ecosystems. 29 references, 8 figures.

12131 **(GAO/RCED—83-200) Information on disposal practices of generators of small quantities of hazardous wastes.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 28 Sep 1983. 33p. General Accounting Office, PO Box 6015, Gaithersburg, MD 20760.

The Federal Government and most States impose less stringent requirements on firms that generate small amounts of hazardous wastes than on those that generate large amounts. This report provides information on federal and state efforts to control disposal practices of these small quantity generators and provides data on the actual disposal methods used by 48 small quantity generators in Rhode Island, Connecticut, Texas, and Louisiana. It also discusses the extent to which occupational safety and health and ground water contamination problems are caused by the disposal of hazardous waste by small quantity generators.

12132 **(GAO/RCED—83-241) Interim report on inspection, enforcement, and permitting activities at hazardous waste facilities.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 21 Sep 1983. 25p. US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760.

Report to The Chairman, Subcommittee on Commerce, Transportation, and Tourism, Committee on Energy and Commerce, House of Representatives.

Owners or operators of facilities where hazardous waste is treated, stored, or disposed of are subject to federal controls. This interim report presents data on key elements of the federal hazardous waste regulatory program established by the Resource Conservation and Recovery Act of 1976. Overall, GAO found that: many facilities in the four states it sampled are not in compliance with the ground water monitoring and closure, postclosure, and financial responsibility requirements or their compliance status is unknown. While most major facilities in two of the four states it sampled were inspected, over half the facilities sampled have not been inspected by responsible state agencies and enforcement actions have not been extensive. The Environmental Protection Agency (EPA) and the states have issued relatively few final permits to the estimated 8000 facilities requiring them - a process that because of the complexities involved could, according to EPA, take up to 10 years to complete. Because of the limited permitting experience, it is too early to assess EPA's current permitting priority system.

12133 (GSF-A—3/83, pp 59-75) **Regional nuisance analysis for evaluation of the ecologic effects of strategies for the utilization of fossil energy sources.** Halbritter, G. Apr 1983. (In German). Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). (CONF-830159—).

From Seminar of Gesellschaft fuer Strahlen- und Umweltforschung on SO/sub 2/ and the consequences; Munich, F.R. Germany (20 Jan 1983).

With the aid of analyses the effects of different strategies for utilizing fossil energy sources on the nuisance situation in a regional range (> 100 km) are investigated, such as, e.g., the replacement of existing old power plants by newer ones. The first part of the analysis consists in establishing the regional distribution of emissions as a function of stack height. On the basis of these data calculations concerning the long-range propagation and deposition of pollutants are carried through. This is done by means of the MESOS trajectories-and-puff model. The calculated nuisances in the area of western and central Europe (44°-62° N, 10°W-20° E) are evaluated with regard to typical damage-related indicators, to permit a comparison of the above-mentioned utilization strategies. First calculations for emittors of various heights have shown that also a part of the polluting matter emitted by low stacks is transported over a long distance.

12134 (GSF-A—3/83, pp 77-89) **SO_2 problem from the viewpoint of the energy economy.** Zimmermeyer, G. Apr 1983. (In German). Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). (CONF-830159—).

From Seminar of Gesellschaft fuer Strahlen- und Umweltforschung on SO/sub 2/ and the consequences; Munich, F.R. Germany (20 Jan 1983).

The measures taken so far by the German bituminous-coal-processing power economy with regard to prevention are unparalleled as compared to those of other European countries and the preventive measures taken in the forest itself. The allegation, defended with such force practically in the Federal Republic alone, of SO_2 being the global cause of the observed forest damage, may catch on politically even if scientists, especially in the United Kingdom and the USA, throw in considerable, substantiated doubts. But science has the responsibility to corroborate any requests for further reduced emission and substantiate the prospects of their success.

12135 **(PB—83-262782) Environmental considerations for the industrial development sector.** (International Bank for Reconstruction and Development, Washington, DC (USA)). Aug 1978. 138p. NTIS.

The purpose of this document is to provide guidelines for consideration and attention as an integral part of the industrial expansion and growth process. Past experience in many of the developed countries has shown that where little or no consideration was given to environmental protection during the industrial development period the correction of damages to the environment has been both slow and costly. The principles presented in this document are intended as general guidelines only. Since no two situations are exactly alike, modification may be necessary for application of these guidelines to specific circumstances.

12136 **(PB—83-262790) Consideraciones ambientales para el sector de desarrollo industrial (Environmental considerations for the industrial development sector).** (International Bank for Reconstruction and Development, Washington, DC (USA)). Aug 1978. 161p. NTIS.

The purpose of this document is to provide guidelines for consideration and attention as an integral part of the industrial expansion and growth process. Past experience in many of the developed countries has shown that where little or no consideration was given to environmental protection during the industrial development period the correction of damages to the environment has been both slow and costly. While the material has been prepared primarily for use by the staff of The World Bank, its use by other institutions and agencies is both welcomed and encouraged. It is hoped that the document will be particularly helpful to administrators, managers, planners, environmentalists, and other officials--both public and private--concerned with industrial development. It is further hoped that for them the document will provide a useful orientation and guidance.

12137 **(PB—83-262808) Protection de l'environnement dans l'industrie (Environmental considerations for the industrial development sector).** (International Bank for Reconstruction and Development, Washington, DC (USA)). Dec 1980. 145p. NTIS.

Critical to any nation's economic development is its growth in the industrial sector, generally accompanied by a shift of population from rural to urban areas and by the creation of new environmental hazards. The purpose of this document is to provide guidelines for consideration and attention as an integral part of the industrial expansion and growth process. Past experience in many of the developed countries has shown that where little or no consideration was given to environmental protection during the industrial development period the correction of damages to the environment has been both slow and costly.

12138 **(PB—83-264689) Environmental management of urban solid wastes in developing countries: a project guide.** Cointreau, S.J. (International Bank for Reconstruction and Development, Washington, DC (USA). Urban Development Dept.). [nd]. 224p. NTIS.

The project guide provides information and procedures for planning and implementation of solid waste management improvements. It is designed to facilitate project preparation, appraisal and implementation of Bank financed solid waste projects in urban areas. Current Bank objectives, policies, and project requirements are summarized. It should also be of use to a wide audience involved in solid waste collection and disposal in developing countries. The project guide reflects the lessons and experience gained from World Bank solid waste projects. The text discusses establishment of an acceptable standard of collection and disposal service delivery, selection of appropriate technology, development of suitably phased action plans, arrangement of institutions for planning and management, arrangement of financial resources, development of regulatory and enforcement support services, provision of public education and participation programs, and incorporation of incentives and disincentives to facilitate project success.

2904 Natural Resources

REFER ALSO TO CITATION(S) 11491, 11492, 11513, 11713, 12160, 12747

12139 **(PB—83-263913) Municipal water supply project analysis: case studies.** Lamson-Scribner, F.H. Jr; Huang, J.W. (International Bank for Reconstruction and Development, Washington, DC (USA). Economic Development Inst.). 1977. 520p. NTIS.

Contents: General case studies; Sector studies, master plans and demand forecasting; Discounting and its applications; Accounting and finance; Water rate structures and pricing; Economic analysis; Project management.

12140 **(PB—84-100668) Classification of the California desert for geology-energy-mineral resource potential geostatistical classification.** Lambie, F.W.; Harbaugh, J.W.; Kendall, G.R.; Juilland, J.D. (Terradata, San Francisco, CA (USA)). May 1983. 183p. NTIS, PC A09/MF A01.

Lands in the California Desert (over 100,000 square kilometers) were classified according to their potential for geology, energy, and mineral (GEM) resources. Several methods were used. Technical Note 359 presents the method which used geo-statistical techniques. All available data on GEM resources were collected, including 3146 mineral occurrences. Eighty variables, lithologic, structural, lineament, tonal, and geochemical, were identified and recorded on a cell-by-cell basis. Data were encoded in numerical form for 26,810 cells, each 2 km by 2 km. Data recorded in this fashion plus the data on GEM occurrences served as the basis for statistically classifying cells according to the likelihood of mineral occurrence. Discriminant function analysis (DFA) is the statistical method used. The cells are classified with respect to their potential for gold deposits, iron deposits, manganese deposits, tungsten deposits, combined copper, zinc, lead, and silver deposits.

12141 **(PB—84-104843) Constrained input-output simulations of energy restrictions in the food and fiber systems. Agricultural economic report.** Penn, J.B.; Irwin, G.D. (Economic Research Service, Washington, DC (USA). National Economic Analysis Div.). Feb 1977. 21p. (AER—280). NTIS, PC A02/MF A01.

The energy shortages of the recent past have prompted a keen awareness of the pervasiveness of direct and indirect energy utilization in the domestic economy. Analysis of the relationship of energy to various components of the economic system requires treatment of the components in a total economic setting. Since the United States has a consistent set of national income accounts and their production account transforms into a sectoral input-output (I/O) tableau, I/O techniques appear to be a feasible way of incorporating this interrelatedness. The model utilized in this study is the readily available I/O construct incorporated into a linear programming framework and appended with BTU energy resource shortages are explored for a representation of the food and fiber system in the context of sector interdependence.

12142 **Introduction to estimation of reserves and resources.** Adelman, M.A. (Massachusetts Inst. of Tech., Cambridge); Houghton, J.C. pp 1-25 of Energy resources in an uncertain future: coal, gas, oil, and uranium supply forecasting. Adelman, M.A.; Houghton, J.C.; Kaufman, G.; Zimmerman, M.B. Cambridge, MA; Ballinger Publishing Company (1983).

Part I examines the economic theory of natural resources and how markets deal with exhaustible resources. The unique aspect of mineral economics is the fixity of supply; new resources represent a stock that, once exhausted, will not be replenished. Because resource appraisals are used to make public policy decisions, resource availability models should be evaluated in terms of their contribution to strategic decisions as well as their sensitivity to regulatory decisions, such as environmental legislation. 10 references, 9 figures, 1 table.

12143 **Comparisons, recommendations, and conclusions.** Zimmerman, M.B. (Univ. of Michigan, Ann Arbor). pp 385-393 of Energy resources in an uncertain future: coal, gas, oil, and uranium supply forecasting. Adelman, M.A.; Houghton, J.C.; Kaufman, G.; Zimmerman, M.B. Cambridge, MA; Ballinger Publishing Company (1983).

Part VI synthesizes parts III-V by placing resource and reserve estimates in the context of a cumulative cost curve. It notes that resource and reserve data are useful only to the degree that cost numbers can be attached to them. Coal is the exception to the conclusion that the discovered portion of energy resources tell us little about the future cost trajectory. Four appendices develop a simplified calculation of the optimal depletion rate, develop decline and depletion rate curves, compare the Soviet reserve classification system, and present evidence of strippable coal reserves. 12 references, 2 tables.

2905 Research, Development, Demonstration, And Commercialization

REFER ALSO TO CITATION(S) 12122, 12153, 12154, 12198, 12200, 12203, 12206

12144 **(BEOP—22) Interim report on the National Research Program Solar Energy per 31 December 1982.** Joon, K. (Stichting Energieonderzoek Centrum Nederland, Petten). Sep 1983. 71p. (In Dutch). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84750757.

Portions are illegible in microfiche products.

A survey is presented of the research projects executed within the framework of the National Research Program on Solar Energy (Nationaal Onderzoekprogramma Zonne-energie; NOZ). Projects deal with water heating in the low and medium temperature range, space heating, cooling, heat storage, system design and testing. Technical investigations are carried out; simulation programs for system design are developed, and (improved) climatological models for solar radiation became available. Work on information, transfer of know-how and education slowed down somewhat. International co-operation with EC and IEA partners was extended considerably.

12145 **(GAO/RCED—83-192) Reasons for the termination of, and DOE losses in, a geothermal demonstration powerplant project.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 29 Sep 1983. 16p. US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760.

The 50-megawatt Baca geothermal demonstration powerplant project, located in northern New Mexico, was the Department of Energy's (DOE's) initial effort to demonstrate geothermal powerplant technology. The project, started in 1978, was believed to have a high probability of success, and its cost was to be shared equally with the industry participants. GAO's review showed that the project was terminated in January 1982 because sufficient geothermal steam to operate the powerplant could not be obtained. The early termination resulted in DOE paying a disproportionate share - $45 million, or 64% - of the $70 million spent on the project because it had paid the majority of the powerplant-related costs at

that time. However, a portion of these costs may be recovered through the sale of powerplant equipment. DOE indicated that it learned lessons from this experience and will act to prevent these problems from occurring on other projects.

12146 **(NP—4770086) Large-scale research and industry.** (Arbeitsgemeinschaft der Grossforschungseinrichtungen (AGF), Bonn (Germany, F.R.)). Apr 1983. 38p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84770086.

The twelve large-scale research institutions existing in the Federal Republic of Germany which employ 16000 people among these 8000 scientists and technicians have formed a 'Work group of large-scale research institutions (AGF)'. This scientific organisation, the AGF promotes exchange of information and experience among the members, coordinates research and development projects, carries out tasks of common interest and represents the interests of large-scale research towards outside. The large-scale research institutions cooperate closely with universities as well as extramural research institutions and industrial companies in Germany and abroad. Many scientists working in large-scale research institutes also belong to the teaching staff of universities of their countries of residence. Cooperation between large-scale research institution and industry takes place by means of cooperation agreements, contracts on application of knowledge, and, to a certain extent, by means of development societies. International cooperation of large-scale research institutions with about 1000 research institutes in the whole world is governed by numerous agreements and contracts on almost all areas of research.

12147 **(RISO-M—2374) Progress report 1 January 1981 - 31 December 1982 computer installation.** (Risoe National Lab., Roskilde (Denmark)). May 1983. 53p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE83703920.

This report describes selected parts of the activities at the Computer Installation of Risoe National Laboratory in 1981 and 1982. Information given may be preliminary.

2906 Nuclear Energy

REFER ALSO TO CITATION(S) 11513, 11553, 11554, 11558, 11581, 11632, 11637, 11656, 11659, 11660, 11929, 12114, 12143, 12160, 12199

12148 **(AD-A—131861/7) Soviet shift in emphasis from nuclear to conventional. Volume 1. The long-term perspective. Research contribution.** McConnell, J.M. (Center for Naval Analyses, Alexandria, VA (USA). Naval Studies Group). Jun 1983. 44p. (CRC—490-VOL-1). NTIS, PC A03/MF A01.

These two volumes detail the shift over time in the Soviet selection of military options. Volume I deals with changes in their long-term perspective on military development. Having achieved a nuclear counter to the U.S. strategy of massive retaliation in the early sixties. Moscow at first favored a long-term conventional emphasis as a follow-on, but abandoned this in 1965 in favor of nuclear options. However, in 1976-77, the Kremlin returned to a primary conventional orientation, rounded out recently with a declared policy of no first use of nuclear weapons. All these shifts seem to have been reflected in changes in Soviet deterrence criteria and, considering their character and timing, may perhaps be best explained as symmetrical reaction to concurrent U.S. plans.

12149 **(AD-A—131862/5) Soviet shift in emphasis from nuclear to conventional. Volume 2. The mid-term perspective. Research contribution.** McConnell, J.M. (Center for Naval Analyses, Alexandria, VA (USA). Naval Studies Group). Jun 1983. 69p. (CRC—490-VOL-2). NTIS, PC A04/MF A01.

These two volumes detail the shift over time in the Soviet selection of military options. Volume II deals with the implementation of the long-term perspective in mid-term doctrinal increments that coincide with the five-year plans. In each of the doctrinal periods since 1960, the Soviets have managed to introduce a new independent option: all-out nuclear war (1960-65), a conventional local war in the Third World (1966-70), limited intercontinental nuclear warfare (1971-75), theater nuclear war (1976-80), and protracted conventional war between the two coalitions (1981-85).

12150 **(AD-A—132122/3) Long range strategic planning. An applied model. Master's thesis.** Kennard, C.W. Jr. (Naval Postgraduate School, Monterey, CA (USA)). Jun 1983. 125p. NTIS, PC A06/MF A01.

This thesis addresses the issue of long range strategic planning. The model developed in Chapter One is meant to be a conceptual framework around which the complex issues of U.S. foreign policy can be organized. Chapters Two through Five apply this model to U.S. apply this model to U.S./South African relations, Chapter six is a case study of South African Nuclear Capabilities.

12151 **(AD-A—132124/9) Prospects for nuclear proliferation. Master's thesis.** Phillips, D.W. (Naval Postgraduate School, Monterey, CA (USA)). Jun 1983. 150p. NTIS, PC A07/MF A01.

This study surveys and analyzes various problems relating to the proliferation of nuclear weapons and the future of the nonproliferation regime. Nuclear proliferation is the intersection of a number of important issues, none of which individually will decide how events will unfold. The growing number of nuclear power industries throughout the world has led to the widespread availability of the necessary nuclear technology and fissile material usd to construct nuclear weapons. The capability is thus becoming increasingly available to many national leaders. The motivations for a country to go nuclear could change rather suddenly in an international system which is plagued by a greater fragmentation and diffusion of power. This study finds that: (1) the present fragile nuclear nonproliferation regime is inadequate to limit the spread of nuclear weapons; (2) the world is gradually moving into a period in which it may soon contain from 15 to 20 nuclear states; and (3) the danger will be all the greater that a brush-fire war involving any one of them may take on global dimensions.

12152 **(DOE/EIA—0439(83)) Survey of nuclear power plant construction costs, 1983.** (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). Dec 1983. 74p. NTIS, PC A04/MF A01 - GPO. Order Number DE84004380.

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This report presents cost estimates, chronological data on construction progress, and the physical characteristics of nuclear units in the construction pipeline, collected on Form EIA-254. The information on US nuclear power plants in the construction pipeline is reported voluntarily each quarter by the electric utilities. This report presents the data collected in the first quarter of 1983 on the 71 nuclear units in the construction pipeline. Historical data on 73 units, totalling 57,287 net megawatts (MWe) of design capacity, in commercial operation as of March 31, 1983, are also given. Three types of information are included: plant characteristics and ownership, construction costs, and construction schedule or chronology. Summary statistics are presented on direct component costs and construction leadtimes for a sample of operating units and units in the construction pipeline. The reactor-specific cost data included in Chapter 4 are the estimated final nuclear production plant costs and, for units in the construction pipeline, the disbursed and sunk costs as of March 31, 1983. 7 figures, 5 tables.

12153 **(EUR—7917) 1981 Annual Status Report. Plutonium fuels and actinide programme.** (Commission of the European Communities, Karlsruhe (Germany, F.R.). European Inst. for Transuranium Elements). 1981. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703921.

In this 1981 report the work carried out by the European Institute for Transuranium elements is reviewed. Main topics are: operation limits of plutonium fuels: swelling of advanced fuels, oxide fuel transients, equation of state of nuclear materials; actinide cycle safety: formation of actinides (FACT), safe handling of plutonium fuel (SHAPE), aspects of the head-end processing of carbide fuel (RECARB); actinide research: crystal chemistry, solid state studies, applied actinide research.

12154 Evolution of nuclear power in the USA. Davis, W.K. (Department of Energy, Washington, DC (USA)). pp 49-59 of Nuclear power experience. Proceedings of an international conference held by the IAEA in Vienna, 13-17 September 1982. Vol. 1 is entitled "Planning and development of nuclear power programmes". Vienna, Austria; International Atomic Energy Agency (1983). (CONF-820914—Vol.1; IAEA-CN—42/38).

From International conference on nuclear power experience; Vienna, Austria (13 Sep 1982).

The development and deployment of commercial nuclear power in the USA has been impressive since the programme began in the early 1950's. Today there are 73 commercial power reactors operating in the USA with combined capacity of about 56 GW(e). By 1990, an additional 64 nuclear power plants with a total capacity of approximately 123 GW(e) will be in operation supplying about 25% of US electrical energy requirements. Despite the cancellation of 91 new units since 1972 and lack of any new plant orders, there is a clear and continuing role for nuclear energy in the USA if we are to experience continued economic growth. New growth for US nuclear industry requires several things to happen. The prospective demand for electricity and new generating plants must increase; the US Government must show that it will fulfill its responsibilities to dispose of nuclear waste; a more stable regulatory process must be implemented so that nuclear power plants can be built with a reasonable degree of assurance beforehand as to what the final design, cost and schedule will be. President Reagan's July 1981 policy statement on Non-Proliferation and Peaceful Nuclear Co-operation and the October 1981 Domestic Nuclear Policy Statement provide the policy framework necessary for the USA to maintain a viable domestic nuclear industry to enable nuclear power to make its essential contribution to future US energy needs and to re-establish the USA as a predictable and reliable partner for international nuclear co-operation under adequate safeguards. The US Government has structured its programmes and activities to implement these policies and initiatives.

12155 Nuclear energy for the Federal Republic of Germany. Roser, T. Bonn, Germany, F.R.; Deutsches Atomforum e.V. (1982). 16p. Deutsches Atomforum e.V., Bonn (Germany, F.R.).

Nucelar fission was discovered in Germany in 1938. Since then, the use of nuclear energy for peaceful purposes has made considerable progress. Today, in the Federal Republic of Germany, nuclear energy is a fact of life, but also a political issue. Energy demand and the environment, international cooperation and non-proliferation, technology and public opinion, are only some of the catchwords indicating the debate in which nuclear energy is caught up. The present brochure is meant to provide a comprehensive and balanced view of nuclear energy in the Federal Republic of Germany today.

2907 Transport And Storage

REFER ALSO TO CITATION(S) 12110, 12335

2908 Waste Heat Utilization

REFER ALSO TO CITATION(S) 12279, 12280, 12287, 12290, 12291, 12292, 12293, 12294, 12295, 12296

2910 Conservation

REFER ALSO TO CITATION(S) 12115, 12166, 12227, 12300, 12301

12156 (DOE/RG/08683—T4) Utility regulation and the legislative process in Oregon: a case study. (National Regulatory Research Inst., Columbus, OH (USA)). Jan 1979. Contract AC01-77RG08683. 109p. NTIS, PC A06/MF A01. Order Number DE84005898.

This case was one of five selected for publication and broad distribution to demonstrate to public utility commissions how certain states have implemented innovative energy management and conservation programs. The Oregon energy conservation program was selected because of its skillful use of the legislative process and the implementation of a package of laws designed to address various elements of energy management and conservation. Two major bills in that package require gas and electric utilities and other energy suppliers to provide information and assistance to residential space heating customers in connection with the financing and installation of weatherization services for homes. Other new laws provide for income tax credits for residential weatherization; special funds for weatherization by low-income, elderly persons; and the need to meet energy conservation standards to qualify for certain veterans' home loans. Finally, an important piece of legislation creating a Domestic and Rural Power Authority represents an effort to obtain more federal electric power from Bonneville Power Administration facilities. This case study devoted considerable space to a description and account of the strategies employed by the Public Utility Commissioner and the Oregon Department of Energy in the design, passage and implementation of a set of energy conservation bills. The following items are also described in some detail in this case study: the work of key personnel during the legislative year; the use of research to develop new legislative concepts in energy management and conservation; the development of support from public and private sector groups by means of education; ways to cope with limited staff resources, and political competition and strong individual differences; and how to negotiate compromises acceptable to the greatest number of legislators and interest groups.

12157 (DOE/RG/08683—T7) Energy management and conservation in Arkansas: a case study. (National Regulatory Research Inst., Columbus, OH (USA)). Dec 1978. Contract AC01-77RG08683. 104p. NTIS, PC A06/MF A01. Order Number DE84005899.

Following a nationwide survey of state public utility commissions, The National Regulatory Research Institute (NRRI) identified sixty-six utility-related energy management and conservation programs that could serve as candidate case studies. Each of the potential case studies was evaluated according to nine criteria, and five cases were selected. The purpose of the case study is to provide state public utility commissions with practical information about how another state implemented a specific energy management and conservation program. Arkansas was selected as one of the final case studies because of the large number of innovative conservation programs undertaken and because of the joint activities existing between the Arkansas Power and Light Company (AP and L) and the Arkansas Public Service Commission (PSC). The energy management and conservation programs examined were divided into three categories: regulatory activities, joint activities, and unilateral activities. Regulatory activities include three AP and L rate cases and the fuel adjustment clause. Jointly initiated activities include the mandatory time-of-day pricing experiment and a management audit of AP and L. Unilaterally initiated programs include AP and L's radio-controlled air conditioner program, the Energy Saving Home, and the Energy Audit. The report describes each of the energy management and conservation programs and assesses the impact each of the above factors has had upon their development. The report concludes that without the existence of the innovative factors identified, several of the utility-related energy management and conservation programs may not have been undertaken.

2920 Supply, Demand, And Forecasting

REFER ALSO TO CITATION(S) 11456, 11513, 11518, 11522, 11536, 12165, 12169, 12524

12158 (CEGB-P—5) Sizewell 'B' power station public inquiry: CEGB proof of evidence. Scenarios and electricity demand. Davies, C.H. (Central Electricity Generating Board, London (UK)). Nov 1982. 152p. NTIS (US Sales Only), PC A08/MF A01. Order Number DE83703919.

The CEGB's case for constructing new generating plants is considered. Firstly forecasting procedures within the electricity supply industry are outlined. Assessments of electricity demand in the medium term are discussed. These are relevant to a capacity need argument and the economic estimates underlying them. Longer term assessments which are primarily related to an econom-

ic need argument are then considered. Work on world economic growth, UK economic growth, UK energy demand and electricity demand on the CEGB is set out.

12159 **(PB—83-263137) Energy in the developing countries.** (International Bank for Reconstruction and Development, Washington, DC (USA)). Aug 1980. 105p. NTIS.

The sharp rise in the cost of energy in recent years has underlined the urgent need to expand domestic energy production in developing countries that are dependent on imports. In 1980, they will spend almost US$50 billion on importing oil. By maximizing energy production between now and the end of the decade and by a vigorous program of energy conservation, the World Bank estimates that these countries could cut their oil-import bill in 1990 by $25-30 billion (1980 dollars). Measures outlined in the paper show it is possible to save about 15 percent of the energy needed in 1990, without having to reduce overall economic growth. It is also imperative that all countries, industrialized and industrializing, adjust their domestic energy prices, incentives, and investment priorities to place more emphasis than at present on domestic production.

12160 **Energy resources in an uncertain future: coal, gas, oil, and uranium supply forecasting.** Adelman, M.A.; Houghton, J.C.; Kaufman, G.; Zimmerman, M.B. Cambridge, MA; Ballinger Publishing Company (1983). 461p. Ballinger Publishing Co., Cambridge, MA.

This book analyzes the economics of resource and reserve estimation. Current concern about energy problems has focused attention on how we measure available energy resources. The five parts of this book take an in-depth look at resource and reserve estimation for oil, gas, coal, and uranium. The goal is not to provide a good estimate of what lies beneath the surface of the earth, but to deal with the crucial concepts lying behind resource and reserve estimation. What do geologists measure and how well does this interact with the economists' notion of supply? The fault in estimation is rarely geological but, rather, economic. The concept of abundance is an economic one, and the authors ask what geological information means when interpreted in light of economic reasoning. The 27 chapters of the book are distributed under 6 parts, including an introductory part. A separate abstract was prepared for each of the 6 parts.

12161 **Proceedings of the IASTED energy symposia: modelling, policy and economics of energy and power systems; alternative energy sources and technology.** Hamza, M.H. (ed.). Anaheim, CA; ACTA Press (1981). 209p. (CONF-810574—). ACTA Press, P.O. Box 2481, Anaheim, CA 92904.

From International Association of Science and Technology for Development energy symposium; San Francisco, CA, USA (20 May 1981).

A separate abstract was prepared for each of the 47 papers of the proceedings for the Energy Data Base (EDB). Ten of the abstracts will appear in Energy Research Abstracts (ERA) and 27 in Energy Abstracts for Policy Analysis (EAPA).

2930 Policy, Legislation, And Regulation

REFER ALSO TO CITATION(S) 11515, 11516, 11517, 11519, 12150, 12174, 12179, 12181, 12183

12162 **(GAO/RCED—84-24) Conditions that limit using barter and exchange to acquire national defense stockpile materials.** (General Accounting Office, Washington, DC (USA). Office of the Comptroller General). 19 Oct 1983. 24p. US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760.

Report to The Chairman, Subcommittee on Preparedness, Committee on Armed Services, United States Senate.

The National Defense Stockpile is maintained to prevent US dependence on foreign sources of strategic and critical materials during national emergencies. Limited appropriated funds to meet stockpile goals have created interest in barter and exchange as alternatives to cash purchases. These alternatives involve trading federal property for needed stockpile materials. Federal agencies have the legislative authority to use barter and exchange. However, they have used these methods sparingly because of restrictive legislative requirements and competing national interests, such as programs having potential needs for commodities that could be bartered. Thus, the current potential for using barter and exchange appears to be limited. GAO recommends that the Emergency Mobilization Preparedness Board, as part of its review of national defense stockpile goals and policies, assess the role barter and exchange can play in meeting stockpile needs and propose legislative changes if necessary.

12163 **(GAO/RCED—84-28) Information on the proposed transfer of the Department of Energy's functions.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 25 Oct 1983. 21p. US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760.

Report to The Chairman, Subcommittee on Fossil and Synthetic Fuels, Committee on Energy and Commerce, House of Representatives.

In December 1981 the administration proposed to transfer the Department of Energy's functions to several federal agencies, principally to the Department of Commerce. The administration believed that energy matters did not require the attention of a separate Cabinet-level department and energy functions could be transferred to various other agencies. This report answers a series of questions on specific areas of the proposal.

12164 **(NP—4770069) Italy - energy situation 1981.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Mar 1983. 44p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84770069.

The energy situation of this country is reviewed on the basis of some relevant data. Its national and international energy policy is commented on and developments in electric power generation and power consumption are described as well as the trends observed for the various energy sources.

2940 Fossil Fuels

REFER ALSO TO CITATION(S) 11456, 11458, 11458, 11480, 11481, 11482, 11490, 11491, 11491, 11492, 11492, 11513, 11514, 11516, 11517, 11519, 11520, 11520, 11522, 11536, 11543, 11549, 12143, 12160, 12183, 12184

12165 **(CEGB-P—6) Sizewell 'B' power station public inquiry: CEGB proof of evidence. Fossil fuel supplies.** Hughes, P.R. (Central Electricity Generating Board, London (UK)). Nov 1982. 144p. NTIS (US Sales Only), PC A07/MF A01. Order Number DE83703916.

Forecasts of the future price and availability of fossil fuels in the UK are presented. Firstly the assumptions and methodology used in constructing three world energy cases for 1980-2030 are outlined. Three world fossil fuel price projections are then derived. The assessment of the prospects for UK fossil fuel supply is discussed and a detailed analysis of the coal industry is made. Fossil fuel prices to the CEGB and final customers in the UK are estimated for each of the five UK economic scenarios. Finally a comparison is made between CEGB projections and other studies.

12166 **(CONF-8111193—) Substitution potentials in the energy sector.** (Gesellschaft fuer Energiewissenschaft und Energiepolitik e.V., Bonn (Germany, F.R.)). 1982. 214p. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE84770150.

From GEE annual meeting (Gesellschaft fur Energiewissenschaft und Energiepolitik e.V.); Bonn, F.R. Germany (30 Nov 1981).

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The "Gesellschaft fuer Energiewissenschaft und Energiepolitik (GEE)", founded in spring 1981, held its first annual meeting on November 30th / December 1st, 1981, under the general topic "Substitution potentials in the energy sector". The programme of the meeting is reprinted in the annex to the report. The volume contains those papers read for which manuscripts were submitted to the managing committee, and summaries of the most important discussions. The main topics of the meeting were: Long-term aspects of energy substitution, substitution of other energy sources for min-

eral oil in the main regions of the world, substitution in the end use energy sector of the Federal Republic of Germany and the significance of individual energy sources as substituants.

12167 **(DOE/EIA—0370(83)) Oil and gas field code master list, 1983.** (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). Jan 1984. 601p. NTIS, PC A99/MF A01 - GPO. Order Number DE84005390.

This report is the second annual listing of all identified oil and gas fields in the United States with field information collected through November 1983. The purpose of the publication is to provide codes for easy identification of domestic fields. A standardization of these field codes will foster consistency in field identification by government and industry. The use of field names and codes listed in this publication is required on the survey forms and reports regarding field-specific data for the Energy Information Administration (EIA) and the Federal Energy Regulatory Commission. A glossary of the terms is provided to assist the readers in more fully understanding the information in this Field Code Master List. 8 figures, 4 tables.

12168 **(GAO/AFMD—83-98) Reviews of the Trans-Alaska pipeline liability fund's financial statements for the years ended December 31, 1982 and 1981.** Bowsher, C.A. (General Accounting Office, Washington, DC (USA). Office of the Comptroller General). 30 Sep 1983. 8p. US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760.

Report to The Congress.

GAO reviewed the reports on the audits of the Trans-Alaska Pipeline Liability Fund's 1982 and 1981 financial statements and the work of the Fund's independent certified public accountant. GAO found nothing to indicate that the opinion of the Fund's independent accountant is inappropriate or cannot be relied on. In the opinion of the independent accountant, the Fund's financial statements present fairly the financial position of the Fund at December 31, 1982 and 1981, and the changes in net assets available for claims for the year then ended, in conformity with generally accepted accounting principles applied on a consistent basis.

12169 **(GAO/NSIAD—84-4) Assessment of US participation in the International Energy Agency's fourth test of its emergency sharing allocation system.** (General Accounting Office, Washington, DC (USA). National Security and International Affairs Div.). 13 Oct 1983. 25p. US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760.

Report to Senator Howard M. Metzenbaum.

This report addresses several key concerns regarding US participation in the International Energy Agency's Fourth Emergency Sharing Allocation System Test (AST-4). The test focused attention on some of the difficulties the United States might face in relying exclusively on market forces to fulfill its international obligations under the IEA System and to cope with the economic impacts of a major oil shortage.

12170 **(GAO/PLRD—83-69) Cost effectiveness of compressed air test procedure for aircraft fuel leaks.** (General Accounting Office, Washington, DC (USA). Procurement, Logistics, and Readiness Div.). 22 Apr 1983. 4p. US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760.

Tactical Air Command (TAC) evaluation of the Test Procedure showed a projected savings of $668,750 in fuel annually. A savings in time, labor, and reduced risk from foreign-object damage to other aircraft in the vicinity were also found. Thus compressors have been authorized for all TAC F-4 aircraft maintenance units. (PSB)

12171 **(GAO/RCED—83-30) Interior should continue use of higher royalty rates for offshore oil and gas leases.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 20 Dec 1982. 46p. US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760.

Report to The Subcommittee on Environment, Energy, and Natural Resources, Committee on Government Operations, House of Representatives.

Over the past few years, State governments, and in a few cases the Interior Department, have increased the royalty rate for offshore oil and gas production. GAO examined the basis for Interior's traditional use of a 16-2/3 percent royalty rate, the results of Interior's and States' leasing experiences in using higher royalties, and the implications of using higher royalty rates for Federal offshore leasing. GAO believes that increased royalties, on a selective basis, appear appropriate and supports continued use of higher royalty rates by the Interior Department in leasing offshore lands.

12172 **(GAO/RCED—83-135) Oil supply disruptions: their price and economic effects.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 20 May 1983. 61p. US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760.

Report to the Chairman, Subcommittee on Fossil and Synthetic Fuels, Committee on Energy and Commerce, House of Representatives.

Large disruptions of 10 and 19 millions of barrels of oil per day could double or triple oil prices and have serious effects on inflation, economic growth, and employment - even under conditions of substantial unused production capacity such as those present during the past year. However, under these slack market conditions, GAO's analysis shows that a small disruption of 3 million barrels per day would have little effect. Under tighter market conditions like those before the Iranian oil cutoff of 1979, there is less unused production capacity to make up for lost production, and disruptions result in larger price increases.

12173 **(GAO/RCED—83-139) Congress should extend mandate to experiment with alternative bidding systems in leasing offshore lands.** Bowsher, C.A. (General Accounting Office, Washington, DC (USA). Office of the Comptroller General). 27 May 1983. 113p. US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760.

The Outer Continental Shelf Lands Act Amendments of 1978 required the Interior Department to experiment with alternatives to the traditional bidding system in leasing offshore lands for oil and gas development. This experiment, extending over a 5-year period, is scheduled to end in September 1983. The alternative systems are designed to reduce the amount of up-front money required by companies to obtain an offshore lease, in return for a greater share of the revenues from any follow-on production. By reducing up-front money, the alternative systems are supposed to increase participation and competition in offshore lease sales. GAO found that the initial effects of the alternative systems on company participation and competition have generally paralleled or bettered the results of the traditional system, although up-front money required to obtain leases was not always reduced as theorized. Additional time and testing are needed before the full effects on the leasing program can be determined. Accordingly, GAO recommends that the legislation be amended to require use of the alternative systems or an additional 5 years so that more information will be available to judge their overall merits.

12174 **(GAO/RCED—83-140) Analysis of the administration's natural gas decontrol plan (S.615).** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 11 Apr 1983. 23p. US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760.

This letter addresses three questions: the short-run impacts of Natural Gas Consumers Regulatory Reform Amendments of 1983 (S.615) on gas supply and prices, defined as the period 1983-87; the extent to which increases in the price of old (low-priced) gas will be compensated by decreases in the price of other categories of gas; and an analysis of the provisions of S.615 designed to influence the renegotiation of existing producer/pipeline contracts. Scope, methods and results are appended. Specifically, results are primarily based on a GAO-developed natural gas supply/demand model which may contain a margin of error. Agency comments were not sought. (PSB)

12175 **(GAO/RCED—83-156) Comparison of Strategic Petroleum Reserve oil prices and commercial oil prices.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 30 Sep 1983. 29p. US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760.

Report to The Chairman, Subcommittee on Commerce, Consumer, and Monetary Affairs Committee on Government Operations, House of Representatives.

During 1981 and 1982, the Federal Government bought about 170 million barrels of oil for the Strategic Petroleum Reserve through long-term contracts and on the crude oil spot market. This report compares the prices that the Government paid for 150 million barrels of this oil with the average prices oil companies paid for the same kind of oil. It also examines whether buying more oil from Western Hemisphere countries could reduce oil acquisition costs.

12176 **(GAO/RCED—83-237) Capital cost associated with the Trunkline Liquefied Natural Gas Lake Charles Facility.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 31 Aug 1983. 10p. US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760.

The actual cost of constructing the LNG facility was about $589 million, an increase of approximately 258% over the $164 million cost estimate approved by the Federal Power Commission (FPC) in 1977. According to reports submitted by Trunkline LNG, the reasons for the increases included extensive modifications to plant design to ensure safe and reliable construction and greater operating efficiency and compliance with state and federal regulations. Also, extension beyond the original estimated completion date, various labor problems, and general inflation resulted in increased labor and interest costs.

12177 **(GAO/RCED—84-11) Status of Strategic Petroleum Reserve activities as of September 30, 1983.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 14 Oct 1983. 29p. US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760.

The Department of Energy reported that during fiscal year 1983 about 83.1 million barrels of oil were delivered to the Strategic Petroleum Reserve, for an annual average fill rate of about 228,000 barrels per day. As of September 30, 1983, the oil inventory of the Reserve was about 361 million barrels. This report discusses a number of significant events which occurred during the fourth quarter of fiscal year 1983 that affect the Reserve. It also discusses the progress being made in filling, developing, and operating the Reserve. Information on a test of the oil distribution procedures, the status of the SPR reorganization, potential problems at the Seaway Terminal, and efforts to collect overpayments for oil received at ST. James Terminal is presented with appendices with supporting figures and tables. (PSB)

12178 **(GAO/RCED—84-19) Congress should consider eliminating requirement for Interior's report on shut-in or flaring wells.** Bowsher, C.A. (General Accounting Office, Washington, DC (USA). Office of the Comptroller General). 24 Oct 1983. 8p. US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760.

This is our fifth annual report to the Congress on the methodology used by the Secretary of the Interior in allowing offshore oil and gas wells to be shut-in (not producing) or to flare (burn off) natural gas. Shutting-in applies to oil and gas wells while flaring applies only to natural gas. Our last three reports have questioned whether Interior's annual report on shut-in and flaring wells - also mandated by the 1978 amendments - continues to serve a useful purpose. We recommended that the Congress repeal section 15 (1) (D) of the OCS Lands Act, as amended, and sections 601 (a) and (b) of the OCS Lands Act Amendments of 1978. Such repeal would abolish the requirement that Interior prepare its annual report as well as the requirement that we annually evaluate the Secretary of the Interior's methodology. We continue to support this recommendation. Eliminating the reporting requirement would not diminish Interior's responsibility for monitoring and regulating OCS lease activities to ensure efficient development of oil and gas resources. Our previous reports have shown that Interior needed to improve its oversight of shut-in and flaring wells. However, during our current review we found that Interior has taken appropriate action to implement our past recommendations and we did not identify any new issues.

12179 **(GAO/RCED—84-59) Financial situation of the Great Plains Coal Gasification Project.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 17 Oct 1983. 6p. US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760.

GAO reviewed drafts of DOE's National Energy Policy Plan IV, calculated synthetic gas prices using Great Plains methodology, converted those prices to current year dollars, and used DOE's computer model of the project's economics to analyze the cash flow forecast. GAO found both the model and the data produced to be reliable. (PSB)

12180 **(NP—4770070) Deminex - business report 1981.** (Deminex-Deutsche Erdoelversorgungsgesellschaft m.b.H., Essen (Germany, F.R.)). [nd]. 13p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84770070.

Description of the activities of this national exploration - and production enterprise of mineral oil- and natural gas industry for the year of the report. Report covers production, field development exploration in the whole world; information on investment, financing and personnel. Balance sheet of 1981 is explained, profit- and loss account for the period 1.1.-31.12.81 is presented.

12181 **(NP—4770090) Gas economy in the global and regional energy supply.** Neu, A.D. (Kiel Univ. (Germany, F.R.). Inst. fuer Weltwirtschaft). Jan 1983. 77p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84770090.

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The explanations in this paper demonstrate first of all the development of the gas consumption in relation to the energy consumption in the world as a whole and individual regions. For individual gas types and individual regions trade flows are analyzed and typical forms the international gas trade has so far taken are discussed, which must, to a large extent, be considered as given for the natural gas supply policy of the Federal Republic of Germany. The most important supply sources of the gas economy in the Federal Republic of Germany and their present distribution systems as well as the parts of the economy to which the gas at home has so far mainly gone are then analyzed. This is to allow inferences of the future central problems of the supply and sales policy of the German gas economy.

12182 **(NP—4900338) World oil equation and the future of Middle East oil.** Stevens, P. (Surrey Univ., Guildford (UK)). 1981. 38p. NTIS (US Sales Only), MF A01. Order Number DE84900338.

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In the early 1970's, the oil revenue per barrel obtained by the oil producers began to rise culminating in the large increases registered in the last quarter of 1973. The impact of this increase in oil price, and the subsequent large increase which occurred in 1979 had an enormous impact upon the oil producers and the world in general. The present conventional wisdom is that the decades of the eighties and nineties will see more of the same at one level or another. The purpose of this paper is to turn that conventional wisdom on its head and argue exactly the opposite, namely that the value of oil revenues during the decade of the 1980's will decline sharply in real terms and that this will generate forces which will have an impact on the Arab oil producers at least as great as the impact of the increased revenue during the 1970's, and these forces in turn will have significant implications for the future of the international oil market and the price of oil. The paper is divided into three parts. The first part examines the future price of oil by setting the market context and then examining supply and demand side factors. The second part examines the impact of declining real oil rev-

enue upon the economies of the Arab countries and the implications for the oil market. Finally, the paper examines a recent development in Saudi Arabia in relation to the structure of the armed forces which suggests that the stability of oil supplies from that country could be vulnerable. 42 references, 5 figures, 8 tables.

2950 Hydrogen And Synthetic Fuels

REFER ALSO TO CITATION(S) 11549

12183 **Synfuels: the Washington perspective.** Harsch, J.W.W. (O'Connor & Hannan, Washington, DC). *Energy Technology (Washington, D.C.);* 9: 520-526(Jun 1982). (CONF-820217—).

From 9. energy technology conference; Washington, DC, USA (16 Feb 1982).

The profile of the federal government has been sharply reduced in synfuels, but the Synthetic Fuels Corporation (SFC) is moving ahead steadily. Eleven projects are under active consideration. The corporation has been declared operational by the President. A sequence of four solicitations have been established through 1984. The SFC strategy will emphasize diversity over production. Congressional objectors to the Corporation appear weakened. The shale oil leasing, among others, are pending. The basic elements of the government synfuel program are in place. It has been concurred that the lead in determining the specifics of development will be left to the private sector.

12184 **Synfuels struggles for identity.** Monks, R.A. (U.S. Synthetic Fuels Corp.). *Energy Technology (Washington, D.C.);* 9: 527-530(Jun 1982). (CONF-820217—).

From 9. energy technology conference; Washington, DC, USA (16 Feb 1982).

One of the unsolved pieces of the puzzle in the Synfuels Corporation is the pay level for senior officers. Directors are charged with establishing an organizational system, setting up offices, and appointing officers. Oversight provisions of "staggering redundancy" are set up to see that the SFC does its job in a limited time (until September 30, 1997). Salaries are high. In Washington, it is "rude and unwelcome to have some johnny-come-lately corporation come along and claim salaries in excess of the norm." Yet SFC directors need to acquire competency and qualifications, and they do not have the psychic compensation or perquisites of cabinet posts. The kind of person needed for SFC must have a predictable compulsion to get the job done and get back to what they were doing before. Federal employees do not have the "demonstrated restlessness." Only senior executives who have a demonstrated capacity to earn +$200,000 will have the motive to carry out Congress's intent in limiting the life of the SFC.

2960 Electric Power

REFER ALSO TO CITATION(S) 11422, 11516, 12115

12185 **(CONF-830696—4) Regional energy facility location models for power system planning and policy analysis.** Hobbs, B.F. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 26p. NTIS, PC A03/MF A01. Order Number DE84004419.

From Operations Research Society of America conference on analytic techniques for energy planning; Washington, DC, USA (7 Jun 1983).

Location models can be used to choose locations for sets of power plants and other energy facilities within single or multistate regions. Because such models can simultaneously consider generation, transmission, fuel supply, and environmental constraints and costs, they can assist in electric system planning. They can also facilitate realistic environmental analysis of energy policies by bridging the gap between national energy models, which project regional energy demands, and pollution dispersion models, which require specific facility locations and pollutant discharge rates. Energy facility location models can also be tools of policy analysis in their own right. They have been applied to environmental questions, such as the impact of alternative air pollution regulations, and economic issues, such as the effect of electric utility deregulation upon electricity prices.

12186 **(DOE/EIA—0226(83/10)) Electric Power Monthly, October 1983.** (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). 12 Jan 1984. 42p. NTIS, PC A03/MF A01 - GPO. Order Number DE84005451.

During October 1983, net generation by electric utilities in the United States was 182,172 gigawatthours (GWh). On a year-to-date basis, net generation at the end of October 1983 was 1.6 percent higher than for the same period in 1982. In October, coal accounted for 56.0 percent of all electricity produced, petroleum for 5.5 percent, gas for 13.1 percent, nuclear power for 13.8 percent, hydroelectric power for 11.4 percent, with the remaining 0.4 percent from geothermal, wood, and waste. In October 1983, electric utilities consumed 50,689 thousand short tons of coal. Petroleum consumption in October 1983 was 16,863 thousand barrels, while gas consumption was 251,120 million cubic feet. On a year-to-date basis, coal consumption at the end of October 1983 was 4.1 percent higher than the same period in 1982, petroleum consumption was 5.9 percent lower than the same period in 1982, and gas consumption was 11.0 percent lower.

12187 **(DOE/EIA—0323(81)) Thermal-electric plant construction cost and annual production expenses, 1981.** (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). Jan 1984. 344p. NTIS, PC A15/MF A01 - GPO. Order Number DE84006235.

Electric energy production from all electric generating plants operated by electric utilities in the United States increased to a new high of 2294.8 billion kilowatthours in 1981. Fossil-fueled steam-electric plants produced 1730.3 billion kilowatthours; nuclear plants produced 272.7 billion kilowatthours; gas-turbine electric plants produced 22.3 billion kilowatthours. The rest of the electric energy was produced mainly from hydroelectric plants. The total installed generator nameplate capacity in the United States from all sources was 634,808 MW as of the end of 1981. Steam-electric plants had a total capacity of 500,664 MW, which includes 60,776 MW of nuclear capacity. Gas-turbine electric plants had a capacity of 51,399 MW. Internal combustion plants had a capacity of 5600 MW, hydroelectric plants had a capacity of 77,145 MW.

12188 **(DOE/ET/29213—T1) Worth of electricity to consumers: a model structure. Final report.** Brown, R.; Lee, W.; Myers, D.; Yabroff, I. (SRI International, Menlo Park, CA (USA)). Jun 1980. Contract AC01-77ET29213. 84p. NTIS, PC A05/MF A01. Order Number DE84005473.

A conceptual model is presented for assessing the worth of utility-supplied electricity as viewed from the consumer perspective. Worth is assumed to be a function of the uses to which electricity is put, not simply a function of the level of electricity consumption. Worth is assessed by analyzing the costs of alternative means for fulfilling functions normally powered by electricity and the tangible and intangible costs that accure to consumers when power outages occur. No applications, validation, or testing of the model are presented.

12189 **(DOE/ET/29213—T2) Large-scale system effectiveness analysis. Sub-problem 3: a conceptual framework for system cost. Final report.** Myers, D.R.; Lee, W.C.; Yabroff, I.W. (SRI International, Menlo Park, CA (USA). Center for Resource and Environmental Systems Studies). 16 Jun 1980. Contract AC01-77ET29213. 89p. NTIS, PC A05/MF A01. Order Number DE84005472.

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The effectiveness of a large-scale electric power system can be measured by four factors: system performance, system availability, system cost, and system worth (from the user perspective). In response to the need for synergistic effectiveness measures. A broad, multi-contractor research project is being conducted to integrate those four categories. This report describes system cost at two levels: a conceptual framework for measuring the total cost of producing electricity under diverse system effectiveness measures, and a set of general cost inputs that relate the framework to specific utility types. In this report, Chapter II describes the general-level conceptual framework for assessing the cost of system effectivenss

attributes. Chapter III shows how the actual costs of a power system can be disaggregated and then integrated into the broad-level conceptual framework. Chapter IV utilizes the conceptual framework and the concepts underlying its development to produce some concrete examples of measures of cost of system effectiveness. Appendix A is a more in-depth look at the cost of fuel, and illustrates the level of analytical detail necessary for putting the framework into practice.

12190 **(DOE/NBM—4005278) Ten year hydro-thermal power program for the Pacific Northwest.** (Bonneville Power Administration, Portland, OR (USA)). Jan 1969. 59p. NTIS, PC A04/MF A01. Order Number DE84005278.

The history of power development in the Pacific Northwest is presented. The following are discussed: factors in attaining regional electric power objective, criteria and data for alternative models, repayment studies, implementation of the thermal power program, and financial requirements. (MHR)

12191 **(DOE/PE—0047) Two views of the Nation's electric future: a comparison of recent studies by the US Department of Energy and the Congressional Research Service.** Skeer, J.; Meyer, D. (USDOE Assistant Secretary for Policy, Safety and Environment, Washington, DC). Feb 1984. 36p. NTIS, PC A03/MF A01. Order Number DE84006268.

Both the US Department of Energy (DOE) and the Congressional Research Service (CRS) have published recent studies of how much generating capability the electric utility industry will need to construct through the end of the century. DOE's study, The Future of Electric Power in America, focuses on the condition of the electric power markets in the United States in terms of the prospects for long-term sufficiency and efficiency of supplies. CRS' study, A perspective on Electricity Utility Capacity Planning, focused on how best to meet demand. Purpose of this paper is to identify and explain the differences between the two studies in terms of purposes, assumptions, methodology, and conclusions.

12192 **(DOE/RG/08077—T2) Wisconsin residential time-of-day rate demonstration project. Final report.** (Wisconsin Public Service Commission, Madison (USA)). 1980. Contract FC01-75RG08077. 78p. NTIS MF A01. Order Number DE84005479.

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Objective was to determine the response of residential customers to time-of-day (TOD) electric rates. Purpose of this report is to describe the study and to summarize the response of the customers to the TOD rates. The report is divided into three sections: historical background of the study, experimental design, and test rates; brief summaries of research papers; and appendix containing these research papers. (DLC)

12193 **(DOE/RG/08683—T2) Energy management and conservation through pricing innovation in Wisconsin: a case study.** (National Regulatory Research Inst., Columbus, OH (USA)). Jan 1979. Contract AC01-77RG08683. 127p. NTIS, PC A07/MF A01. Order Number DE84005897.

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In the fall of 1977 and winter of 1978, the National Regulatory Research Institute (NRRI) conducted a survey of state public utility commissions for the purpose of identifying energy management and conservation programs that could serve as potential case studies. The purpose of the case studies is to provide public utility commissions in one state with information on how commissions in other states have handled energy related problems and instituted programs to cope with such problems. On the basis of nine criteria identified by NRRI, five case studies were selected. The appropriate state utility commissions were then contacted and their participation was arranged. Wisconsin was chosen as one of the five case studies because of the activities of the Wisconsin Public Commission in the sphere of electric rate design. Over a period of several years the Wisconsin PSC has been moving toward time-of-day (TOD) pricing for electric service. This has involved increasing the number of customers on TOD pricing, evolving more elaborate methods for resolving TOD problems, and, in general, dealing with TOD issues in an increasingly sophisticated fashion. Although the decisions issued have generally been in the theme of TOD pricing, the intent of this policy has been to make the cost of service to the customer more closely related to the utility's cost of providing that service and, by sending proper signals to customers of all classes, to reduce overall system demand. Most of the activities of the Wisconsin PSC occurred through decisions and orders in specific rate request procedures. The PCS also conducted a generic environmental impact investigation to assess the impacts of changes in rate structure. This case study thus focuses on the major rate case involved and on the environmental process.

12194 **(DOE/RG/08683—T3) Task 7. Phase one final report.** (National Regulatory Research Inst., Columbus, OH (USA)). Dec 1978. Contract AC01-77RG08683. 54p. NTIS, PC A04/MF A01. Order Number DE84005901.

Two main types of technical assistance activities were envisioned under the first phase of the contract: on-site technical assistance and general technical assistance applicable to the needs of several states. States selected to receive on-site technical assistance were identified on the basis of a nation-wide needs assessment, extensive background data and applications submitted by state regulatory commissions, state energy offices and nonregulated utilities. In all, 21 agencies received on-site technical assistance in areas such as rate case processing, time-of-use pricing, cost of service, data base development, computer modeling, alternate rate structures and demand forecasting. General technical assistance was provided through case studies and a computer inventory. Five states agreed to serve as case studies. Topics covered by the case studies included controlling gas pipeline losses, utility/commission cooperation, home energy conservation, and time-of-use pricing. The computer inventory provided a listing of over 300 computer programs available in the areas of rate design, consumer programs, forecasting and planning and state agency operations. In phase two, additional assistance will be provided by the Institute in 20 separate activities. These activities include fuel adjustment clauses, the New Mexico Cost of Service Index Experiment, solar energy regulatory issues, expense and investment treatment of residential energy conservation measures, a natural gas regulatory simulation model, utility financial analysis, power plant productivity, forecasting and planning, contingency planning, trends in state commission regulation, commission-ordered management audits, National Energy Act Conferences, independent reviews and seven on-site technical assistance projects.

12195 **(DOE/RG/08683—T5) Utility characteristics profile. Task 2B, deliverable.** (National Regulatory Research Inst., Columbus, OH (USA)). 14 Nov 1977. Contract AC01-77RG08683. 124p. NTIS, PC A06/MF A01. Order Number DE84005902.

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This Utility Characteristics Profile is a profile of major electric and gas utilities. The profile provides data on electric and gas use in the nine Electric Reliability Council Regions, in the fifty States and the District of Columbia, and also provides data on all class A and B electric utilities, on the major gas utilities in each state, and on the twenty largest electric and gas municipally owned distribution systems. The profile was developed to assist in selecting or recommending states and municipalities for technical assistance in developing in implementing utility energy conservation programs. Following the terms of Contract No. CR-04-70219, a list of data, specified for the Utilities Characteristics Profile but not readily available by the due date of this Profile, has been sent to The Department of Energy as a Request for Waiver of Data Collection Requirement.

12196 **(DOE/RG/08683—T6) Missouri rate reform initiative: a case study.** (National Regulatory Research Inst., Columbus, OH (USA)). Dec 1978. Contract AC01-77RG08683. 76p. NTIS, PC A05/MF A01. Order Number DE84005900.

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While generic hearings have been an often used means of rate restructuring, rate design objectives can be also achieved through rate cases of the most typical type. Interest in the latter method stems from the belief that its application is less costly in

terms of time and manpower. It is the purpose of this report to describe Missouri's incomplete experience with the restructuring of rates through a normal rate case. Activities of the Missouri Public Service Commission (PSC) during and after the 1976 elections have been termed in this report as the Missouri Rate Reform Initiative. The ultimate goal of the rate reform activities in Missouri is to implement electricity tariffs that reflect fully and accurately the incremental cost of providing electric service. According to the rate reform plan, phase I is to be implemented through the rate case of the St. Joseph Light and Power Company. In this phase, energy charges are to be based on the average hourly cost plus an incremental cost of operating and maintaining the system load. These charges, to be included as a single charge per month, are to be made without consideration of economy purchase or other short-term arrangements between systems. A residual charge is to be implemented, the purpose of which is to recover the difference between revenues thus generated and the cost of operating the system. The following implications were noted: the change from traditional regulatory concerns to the application of new regulatory methods requires a unique regulatory environment; the Missouri approach (initiative) to rate reform may be as time-consuming as generic hearings; the Missouri approach requires the development of in-house staff capability beyond that which might be required by other rate reform approaches; and the Missouri approach requires substantial computer resources.

12197 **(GAO/RCED—84-38) Expanding the Pacific Northwest/Southwest intertie - benefits and impediments.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 4 Nov 1983. 34p. US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760.

Report to The Secretary of Energy.

The Pacific Northwest and California are joined by three high-voltage transmission lines (intertie) which allow for an exchange of electricity between the two regions. The regions benefit from the exchange of power because of the difference in the costs of generating electricity - the Northwest uses relatively low-cost hydropower, while California relies on higher cost oil-and gas-fired generation. In 1980, GAO recommended that the intertie be expanded because California could save about 4 million barrels of oil per year while the Northwest could earn additional revenues from the sale of surplus energy. Since GAO's earlier report, little expansion has occurred although the amount of surplus energy available from the Northwest to California has greatly increased. Because of the benefits to be derived, GAO makes specific recommendations aimed at facilitating expansion of the intertie.

12198 **Small-scale energy projects in the federated states of Micronesia.** Case, C.W. (Lawrence Berkley Lab., Berkley, CA). pp 633 of 5th Miami international conference on alternative energy sources. Vezirogla, T.N. (ed.). Coral Gables, FL; Univ. of Miami (1983). (CONF-821213—).

From 5. international conference on alternative energy source; Miami Beach, FL, USA (13 Dec 1982).

2980 Consumption And Utilization

REFER ALSO TO CITATION(S) 11514, 11521, 11699, 12164, 12195, 12232

2990 Unconventional Sources And Power Generation

REFER ALSO TO CITATION(S) 11513, 11713, 11716, 11717, 11718, 11720, 11734, 11735, 11813, 12144, 12161, 12198, 12198, 12524

12199 **(CEGB-P—3) Sizewell 'B' power station public inquiry: CEGB proof of evidence. Alternative methods of electricity generation.** Wright, J.K. (Central Electricity Generating Board, London (UK)). Nov 1982. 103p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE83703918.

A description is given of the CEGB's current assessment of the potential contribution to electricity generation of those methods considered to be the most significant alternatives to conventional power stations or thermal nuclear reactors for generating electricity. The state of development of the technology, the timescale on which it could be developed, its ability to generate electricity reliably and the cost of generating electricity are some of the matters considered. The following topics are covered: potential developments in coal fired generating plants; combined heat and power generation; energy storage; electricity generation from renewable energy sources; fast reactors and fusion.

12200 **(DOE/CS/66001—3) ECUT Energy Conversion and Utilization Technologies Program. Industry, university, and research institute interest in the US Department of Energy, ECUT Biocatalysis Research Activity.** Wilcox, R.E. (Jet Propulsion Lab., Pasadena, CA (USA)). 1 Nov 1983. Contract AI01-81CS66001. 37p. (JPL-PUB—83-90). NTIS, PC A03/MF A01. Order Number DE84005745.

This report presents the results of a Research Opportunity Notice (RON) disseminated by the Jet Propulsion Laboratory for the US Department of Energy (DOE) Energy Conversion and Utilization Technologies (ECUT) Program's Biocatalysis Research Activity. The RON was issued in late April of 1983 and solicited expressions of interest from petrochemical and chemical companies, bioengineering firms, biochemical engineering consultants, private research laboratories, and universities for participating in a federal research program to investigate potential applications of biotechnology in producing chemicals. The RON results indicate that broad interest exists within the nation's industry, universities, and research institutes for the Activity and its planned research and development program. Both large firms (e.g., Allied, American Cyanamid, Bechtel, Celanese, Genentech, Genex, Martin Marietta, and UOP) and small firms expressed interst in responding to future Request for Proposals (RFPs) issued by the Activity. The specific interest areas of the RON respondents varied widely. For example, biotechnology firms and firms specializing in contracted research seem to have a distinct preference for investigating the technical issues most relevant to near-term (high-value/low-volume) biocatalysis applications. Conversely, the engineering firms that design and build chemical plants expressed strongest interest in the issues most relevant to the longer-term, low-value/high-volume applications of biocatalysis. The various respondents' distinct research preferences emphasize the need for the Activity's mission-oriented strategy that coordinates research and researchers to achieve the technical feasibility of biocatalyzed continuous chemical production processes.

12201 **(DOE/NBM—4004243) Impact of recent federal tax legislation on the renewable energy industry.** (Renewable Energy Inst., Washington, DC (USA). Tax Policy Project). 4 Nov 1982. 90p. Renewable Energy Inst. 2010 Massachusetts Ave., N.W. Washington, D.C. 20036.

The Renewable Energy Institute was asked by the Office of Renewable Technology of the US Department of Energy to analyze the elements of the Economic Recovery Tax Act and report on their significance to the emerging renewable energy industry. That analysis had barely been completed when Congress passed the second act. Because of the signficant impact of this legislation, the report has been expanded to include a discussion of the most important features of the Tax Equity and Fiscal Responsibility Act. An additional appendix covers the relationship of public utility law to various tax code provisions and subsequently, to renewable energy projects in general. While the impacts of these legislative changes have only begun to be registered, this 83-page report outlines several areas of grave concern to the emerging renewable energy industry. Most notably, the loss of tax benefits through the reduction in basis, the reduction of anticipated depreciation benefits in 1985 and 1986 and several other provisions together could severely limit the ability of emerging renewable energy technologies to effectively compete with conventional energy sources and contribute their full potential toward our nation's energy supply needs. Through numerous detailed examples, the report demonstrates how recent tax legislation has affected renewable energy development, and how the treatment of renewable energy investments compares with the treatment of conventional energy investments.

12202 **(DOE/SF/11573—T1-Vol.3) Active Program Research Requirements (APRR). Final report. Volume III. Appendices B-N.** (Science Applications, Inc., McLean, VA (USA). Energy Systems Group). 31 Oct 1983. Contract AC03-81SF11573. 423p. NTIS, PC A18/MF A01. Order Number DE84003110.

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The following appendices are included in this volume: the contribution of system success score; system descriptions; component development plans; cost goal considerations; score sheets for submitted plans; benefit/cost ranking sensitivities; relationship between system cost-effectiveness and improvements in energy conversion subsystems; on-going APRR; conventional systems; survey of DOE R and D planning projects; development of engineering prototype costs from value based cost goals; and actual energy costs.

12203 **(GAO/RCED—83-120) Prospects for continued operation of DOE's Solar Test Facilities and selected aspects of its solar project closeouts.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 21 Apr 1983. 31p. US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760.

Report to the Subcommittee on Energy Development and Applications Committee on Science and Technology, House of Representatives.

The Department of Energy (DOE) has constructed and operated several solar test facilities and projects aimed at advancing the development of solar energy. The subcommittee requested GAO to examine the prospects for DOE's continued operation of five of these solar test facilities and to determine the extent to which DOE will recover its investment and complete data collection activities associated with solar energy projects it is now closing out. GAO found that: DOE will continue operating the test facilities in fiscal year 1983 and that funding for four of these facilities is anticipated for fiscal year 1984; and DOE is taking steps to protect the federal investment in solar projects being closed out. Little, if any, funds are expected to be recovered, but data collection activities will be completed for most projects.

12204 **(GAO/RCED—84-36) Removing barriers to the market penetration of methanol fuels.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 27 Oct 1983. 77p. US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760.

Report to The Chairman, Subcommittee on Fossil and Synthetic Fuels Committee on Energy and Commerce, House of Representatives.

This study examines some of the impediments confronting the development of methanol as a commercially viable transportation fuel. The primary barriers confronting methanol commercialization are economic, and they are largely dependent on the price of competing fuels. There is little the Federal Government can do to influence these economic factors short of providing financial incentives. However, certain federal regulations may present additional though less substantial, impediments. Unlike the economic barriers, regulatory factors are within the control of the Federal Government. GAO believes that certain other measures might be effective at the margin - that is, they would not in themselves create widespread use of or demand for methanol, but they might help. In the short term, the development of a market for methanol fuel may not reduce US reliance on imported energy because low priced foreign methanol is becoming available. This factor is relevant to any decision to promote methanol for national security reasons.

12205 **(NP—4900644) Investigation of particulate emissions and use potential of pelletized fuel, Phase I.** Sanborn, C.R.; Wishinski, P.R.; Hudson, N.; Lamont, D. (Vermont Agency of Environmental Conservation, Montpelier (USA); Vermont State Energy Office, Montpelier (USA)). Mar 1983. 58p. NTIS, PC A04/MF A01. Order Number DE84900644.

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A research study comparing the particulate emissions of three different pelletized fuels (wood, wood/plastic, and refuse-derived fuel[RDF]) was designed to evaluate their effects on ambient air quality, their reliability, and their potential market acceptance. The results do not support a need for specific regulations for commercial or industrial boilers, and it is assumed that residential boilers will exhibit similar behavior. A 10% switch in the residential fuel market to wood-based pellets will not compromise Vermont's air quality standards, partly because pelletized fuel releases fewer particulates than chunk wood fuel. Lead emissions from RDF pellets do pose a potential threat, however. 2 references, 7 figures, 22 tables. (DCK)

12206 **(PB—84-114610) Appropriate industrial technology for energy for rural requirements. Monographs No. 5.** (United Nations Industrial Development Organization, Vienna (Austria)). 1979. 180p. NTIS, PC E09/MF E01.

This report discusses appropriate technology for rural energy supply in developing countries and energy sources for rural requirements. Described are: the planning and development of animal energy resources in India; appropriate technology for rural energy supply in Indonesia; and energy for rural requirements in Pakistan.

30 DIRECT ENERGY CONVERSION

3001 Mhd Generators

REFER ALSO TO CITATION(S) 11847

3004 Thermionic Converters

REFER ALSO TO CITATION(S) 12512

3005 Fuel Cells

REFER ALSO TO CITATION(S) 12536

12207 **(DOE/CH/10124—T2) Fabrication of planar solid oxide fuel cells. Final report, October 1982-February 1983.** Morse, T.F.; Seymour, W.C. (Montanta Energy Research and Development Inst., Butte (USA). Applied Technology Labs.). 1983. Contract AC02-82CH10124. 37p. NTIS, PC A03/MF A01. Order Number DE84005643.

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The goal of this work has been to explore and develop techniques for developing a planar Solid Oxide Fuel Cell (SOFC) technology. The work centered on the development of techniques for developing thin, yttria-stabilized zirconia electrolytes with an associated support structure. To make the goal more meaningul a conceptual model of a SOFC was developed to provide modeling goals for the needed fabrication capability. Several new techniques were developed in the fabrication of the thin zirconia ~ 25 micron (.001") thick. Different techniques yield different electrolyte bodies with different textural and structural properties. These textured electrolytes included a smooth texture, a webbed honeycomb texture and an embossed honeycomb texture. The most successful electrolytes were prepared by screen printing, spraying, and tape casting, all of which will be explained in full detail.

12208 **(DOE/ET/15366—T3) Phosphoric acid fuel cell stack and system development. Final technical report.** Early, J.J.; Johnson, G.K.; Kaufman, A.; Smith, G.A.; Yarrington, R.M. (Engelhard Corp., Edison, NJ (USA). Engelhard Industries Div.). Oct 1981. Contract AC01-78ET15366. 210p. NTIS, PC A10/MF A01. Order Number DE84005477.

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The present report summarizes the progress made under the DOE/NASA Phase II Contract over a period of 28 months. Task I of the Contract was devoted to the development of phosphoric acid fuel cell stack components, Task II to fuel selection and processing, Task III to integrated system design and development, and Task IV

to large stack design and development. Task V, directed toward electrocatalyst improvement, was wholly sponsored by Engelhard as a cost contribution. Highlights of work accomplished under these tasks are presented.

12209 **Evaluation of tetrafluoroethane-1,2-disulfonic acid as a fuel cell electrolyte.** Ross, P.N. Jr. (Lawrence Berkeley Lab., Materials and Molecular Research Division, Berkeley, CA). *Journal of the Electrochemical Society;* 130: No. 4, 882-885(Apr 1983). Contract AC03-76SF00098.

Fuel cell cathode polarization in 70 w/o tetrafluoroethane-1,2-disulfonic acid (TFEDSA) was compared with that observed in trifluoromethane sulfonic acid (TFMSA) and phosphoric acid electrolytes. The type of electrode used was a wet-proofed Stackpole carbon paper substrate with the catalyst layer applied by direct filtration. The catalyst was 10 w/o Pt on Vulcan XC-72R carbon black supplied by Prototech and used as received. The polytetrafluoroethylene (PTFE) content and the curing conditions for the cathodes were optimized for each electrolyte by trial and error. The resulting polarization curves were infrarad corrected and show that all three electrolytes have about the same conductivity under the conditions used. The polarization behavior in TFEDSA was intermediate between that for 85 w/o phosphoric acid and that for 60 w/o TFMSA. More quantitative kinetic measurements in concentrated TFEDSA and also TFMSA were attempted using the rotating disc method but electrolyte impurity problems prevented definite determinations. The polarization results and the conductivity data indicate that it should be possible to operate a reformed methanol (0.1% CO) fuel cell using 70% TFEDSA at 110 degrees C and achieve a potential of 0.64V per cell on air at 200 mA/cm^2 with 0.75 mg Pt/cm^2 of catalyst. An impurity in TFMSA appears to be the source of sulfur produced at a hydrogen electrode in unpurified acid; the impurity is probably SO_3. Early samples of TFESDA were badly contaminated with sulfur oxides but improvement in synthesis eliminated these impurities. Purified forms of TFMSA and TFEDSA showed no chemical instability in the fuel cell tests in this laboratory.

12210 **Solid electrolyte structure.** Fraioli, A.V. US Patent Application 6-452,361. [nd]. 23p. Contract W-31-109-ENG-38.

A solid electrolyte structure for fuel cells and other electrochemical devices is described providing oxygen ion transfer by a multiplicity of exposed internal surfaces made of a composition containing an oxide of a multivalent transition metal and forming small pore-like passages sized to permit oxygen ion transfer while limiting the transfer of oxygen gas.

12211 **High temperature solid electrolyte fuel cell with ceramic electrodes.** Bates, J.L.; Marchant, D.D. US Patent Application 6-463,204. [nd]. 10p. Contract AC06-76RL01830.

A solid oxide electrolyte fuel cell is described having a central electrolyte comprised of a HfO_2 or ZrO_2 ceramic stabilized and rendered ionically conductive by the addition of Ca, Mg, Y, La, Nd, Sm, Gd, Dy Er, or Yb. The electrolyte is sandwiched between porous electrodes of a HfO_2 or ZrO_2 ceramic stabilized by the addition of a rare earth and rendered electronically conductive by the addition of In_2O_3. Alternatively, the anode electrode may be made of a metal such as Co, Ni, Ir Pt, or Pd.

12212 **Molten carbonate fuel cell reduction of nickel deposits.** Smith, J.L.; Zwick, S.A. US Patent Application 6-485,528. [nd]. 13p. Contract W-31-109-ENG-38.

A molten carbonate fuel cell is described with anode and cathode electrodes and an electrolyte formed with two tile sections, one of the tile sections being adjacent the anode and limiting leakage of fuel gas into the electrolyte with the second title section being adjacent the cathode and having pores sized to permit the presence of oxygen gas in the electrolyte thereby limiting the formation of metal deposits caused by the reduction of metal compositions migrating into the electrolyte from the cathode.

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

REFER ALSO TO CITATION(S) 11963

3201 Buildings

REFER ALSO TO CITATION(S) 11717, 11783, 11786, 11791, 11798, 11808, 11848, 12098, 12297, 12298

12213 **(AD-A—131261/0) Use of simplified input for blast energy analysis. Final report.** Herron, D.; Eidsmore, J.; O'Brien, R.; Leverenz, D. (Army Construction Engineering Research Lab., Champaign, IL (USA)). May 1983. 114p. NTIS, PC A06/MF A01.

This study demonstrated that a simplified input to the Building Loads Analysis and System Thermodynamics (BLAST) energy analysis computer program will generate results accurate enough for designers to use during the early stages of the Military Construction, Army (MCA) facility design process.

12214 **(AD-A—132527/3) Analysis of facilities' energy use patterns. Final report.** Sliwinski, B.J.; Elischer, E. (Army Construction Engineering Research Lab., Champaign, IL (USA)). Aug 1983. 73p. NTIS, PC A04/MF A01.

This report describes the development of methods for estimating building energy consumption based on analysis of weather and energy use data. Equations are presented for estimating Army facilities' energy consumption based on daily heating and cooling de gree days. The results of the regression analysis indicated that these equations can be used to estimate energy consumption for aggregates of 10 or more buildings. The equations are useful for all types of Army buildings. Time series analysis of facilities' electrical energy consumption is also described. This analysis provides the Facilities Engineer with a basis for estimating daily electric energy consumption and a methodology for using accurate short-term electrical metering to estimate daily average electrical consumption.

12215 **(AD-A—134006/6) Selection and implementation of single building EMCS (Energy Monitoring and Control Systems). Final report Jan-Jul 83.** Stan, R. (Stan and Associates, Inc., Dayton, OH (UA)). Aug 1983. 241p. NTIS, PC A11/MF A01.

This report addresses the selection and implementation of single-building energy monitoring and control systems. The process is examined in three phases. The initial phase examines the selection of candidate buildings based on metered utility data, examination of building operation, examination of building systems and controls, and measured data. The second phase examined the capability of time clocks, duty cyclers, demand limiters, programmable controllers, micro EMCS and small EMCS. The functions performed by each are examined. Alternatives to EMCS are presented. An example calculation compares time clock control, time clock control with control enhancement, and small EMCS control of a typical air handling unit. The interface techniques for efficient installation and operation. A summary of the analysis steps follows.

12216 **(AD-A—134028/0) Daylighting coefficient of utilization tables. Final report, February-August 1983.** Brackett, W.E. (Applied Software Analysis, Boulder, CO (USA)). Aug 1983. 163p. NTIS, PC A08/MF A01.

Use of daylighting coefficient of utilization tables provides a simple methodology for predicting interior illumination from daylight through windows. Tables are provided for transparent windows, and for windows with vertical and horizontal venetian blinds. The method predicts illuminance at five predefined target points within the room. The source code for the computer program which created the tables is included.

12217 **(CONF-821267—1) Customer response in Department of Energy Load Management Projects.** McConnell, B.W. (Oak Ridge National Lab., TN (USA)). Dec 1982. Contract W-7405-ENG-26. 31p. NTIS, PC A03/MF A01. Order Number DE84004680.

From EPRI load management seminar; San Antonio, TX, USA (8 Dec 1982).

The Department of Energy (DOE), Division of Electric Energy Systems (EES) has completed several tests of customer-side thermal energy storage (TES). These tests include both heat and cool storage and were conducted by eight utilities under contract to the Oak Ridge National Laboratory (ORNL). A limited evaluation of customer acceptance of TES was carried out by each utility. DOE and ORNL are conducting automation and control experiments on the Athens Utilities Board in Athens, Tennessee. Socioeconomic surveys and evaluations of customer response to load management (LM) are being performed before, during and after the experiments. Preliminary results of customer response to the Omaha Public Power District's (OPPD) direct load control of air conditioners project and the remotely controlled demand limiter project are presented.

12218 **(CONF-840124—1) Comparison of field performance of a high efficiency heat pump with an without a desuperheater water heater.** Baxter, V.D. (Oak Ridge National Lab., TN (USA)). 1984. Contract W-7405-ENG-26. 15p. NTIS, PC A02/MF A01. Order Number DE84005816.

From American Society of Heating, Refrigerating and Air-Conditioning Engineers meeting; Atlanta, GA, USA (29 Jan 1984).

An air-to-air heat pump (COP = 3.11 at 47°F (8.3°C)) run alternately with an electric-resistance water heater and a desuperheater water heater was tested under field conditions at a site near Knoxville, TN. Results from these tests indicate that the desuperheater system has an annual performance factor (measured over a six-month period consisting of three winter and three summer months) 14% better than that of the system using electric resistance water heating. An analytical model predicts a 21% improvement over an entire year with average weather for the desuperheater system. The simple payback period ranges from seven years (for a 21% improvement) to about nine years (for a 14% improvement).

12219 **(CONF-840124—2) High-efficiency dual-stroke compressor for heat pumps.** Young, R.R.; Veyo, S.E.; Kastovich, J.C. (Westinghouse Research and Development Center, Pittsburgh, PA (USA)). 1984. Contract W-7405-ENG-26. 43p. NTIS, PC A03/MF A01. Order Number DE84005813.

From American Society of Heating, Refrigerating and Air-Conditioning Engineers meeting; Atlanta, GA, USA (29 Jan 1984).

The development of a high efficiency, two-capacity, three cylinder, reciprocating piston, hermetic compressor for the advanced electric heat-pump is described. The patented capacity modulation concept employs an eccentrically bored circular cylinder cam between crankpin and connecting rod which acts to change the stroke of the compressor upon a change in the direction of rotation of the crankshaft. Complementary design features that result in high efficiency include a circulating oil system that cools the drive motor and the compressor and rejects heat external to the compressor shell, a suction piping system that routes gas into the cylinders in a manner to impede heat transfer, a discharge piping scheme that impedes heat transfer and reduces pressure loss, an improved valve and valve plate system that reduces flow impedance and in conjunction with a crowned piston reduces clearance volume thereby improving both capacity and efficiency, and a high efficiency, dual strength drive motor (not detailed here).

12220 **(DOE/CE/64827—T1) Study of methods to stimulate private investment in hospital energy conservation. Final technical progress report, February 14, 1983-August 31, 1983.** (Blue Cross and Blue Shield Association, Chicago, IL (USA)). Aug 1983. Contract FG01-82CE64827. 3p. NTIS, PC A02/MF A01. Order Number DE84005478.

12221 **(DOE/CE/73011—T1) Technology transfer from the national laboratories to the building industry.** (American Inst. of Architects, Washington, DC). 15 Nov 1983. Contract AP01-83CE73011. 141p. NTIS, PC A07/MF A01. Order Number DE84005670.

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The building industry organizations involved in this project were pleased to have the opportunity to work with DOE in defining their needs regarding solar technology transfer and in planning their approaches to satisfying these needs. This report is the result of this successful collaborative effort and contains individual statements by the building industry organizations participating in the project concerning their memberships, committee structures, and information dissemination mechanisms, as well as recommendations specific to their particular needs and operational characteristics. This report also contains recommendations to further improve technology transfer from the national laboratories to the building industry.

12222 **(DOE/CS/20335—T1) Analysis of CPSC's regulatory methodologies for power mowers and cellulose insulation. Final report.** (Policy Planning and Evaluation, Inc., McLean, VA (USA)). Oct 1979. Contract AC01-79CS20335. 76p. NTIS, PC A05/MF A01. Order Number DE84005694.

The results of an analysis of the Consumer Products Safety Commission's regulatory methodologies for setting power mower and cellulose insulation safety standards are summarized. The report was prepared to aid in developing energy efficiency standards for household appliances. Insight is provided into such matters as the depth of data required to determine regulatory impacts, as well as providing alternative approaches for analyzing available data.

12223 **(DOE/CS/20335—T2) Summary of state energy conservation programs for appliances. Final report.** (Policy Planning and Evaluation, Inc., McLean, VA (USA)). Dec 1979. Contract AC01-79CS20335. 63p. NTIS, PC A04/MF A01. Order Number DE84005693.

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Data reflecting the impact of state appliance programs on the level of efficiency of major household appliances are provided. The data provided here will be utilized in the preparation of a baseline forecast of appliance efficiency. Two conclusions have been reached as a result of the data collection effort for this task. First, only one state, California, has implemented an energy efficiency program that has resulted in significant changes in energy efficiency levels for appliances in that state. California has set minimum efficiency standards for eight product types that are also covered by the National Energy Conservation Policy Act (NECPA). Second, a large number of states are developing or have implemented programs that set minimum efficiency levels for certain appliances and/or have required that certain prescriptive standards be met. Most of the efficiency standards pertain to water heaters and HVAC equipment and are based on ASHRAE 90-75 standards. Forty states were identified as having implemented or are planning to implement ASHRAE-based standards. Most of the prescriptive standards ban the use of gas pilot lights and require the installation of intermittent ignition devices (IID's) in gas heaters, ranges, and dryers. Eleven states were identified that have pilot light bans affecting one or more gas appliances. In addition to the data presented, a number of issues are discussed that may affect the interpretation of the data.

12224 **(DOE/CS/20335—T3) Analysis of institutional demand for household appliances. Final report.** (Policy Planning and Evaluation, Inc., McLean, VA (USA)). May 1980. Contract AC01-79CS20335. 71p. NTIS, PC A04/MF A01. Order Number DE84005691.

The primary objective here is to determine the extent of institutional demand for appliances. Institutional demand refers to sales of appliances that are attributable to new home builders. Other objectives include an analysis of trends in institutional demand and a discussion of the factors that influence institutional demand.

12225 (DOE/CS/20335—T5) Profile of the appliance industry. Final report. (Policy Planning and Evaluation, Inc., McLean, VA (USA)). Mar 1979. Contract AC01-79CS20335. 63p. NTIS, PC A04/MF A01. Order Number DE84005692.

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Section 325 of the Energy Policy and Conservation Act (EPCA) (PL 94-163), as amended by section 422 of the National Energy Conservation Policy Act (NECPA) (PL-95-619), requires that the Department of Energy (DOE) prescribe energy efficiency standards for thirteen types of consumer products. The thirteen covered products fall into the following three categories: major household appliances; consumer home electronics; and environmental comfort appliances. Each section begins with a listing of the covered products included in the chapter. This information is followed by a general description of the industry segment discussed. Included in this discussion are data describing the manufacturing leaders, trends in the industry, and forecasts of future performance. The final section of each chapter will be devoted to a more specific depiction of the industry on an appliance-by-appliance basis. This portion of the report will include: market share data by appliance, by manufacturer; retail value of appliance shipments; unit shipments by appliance; and number of manufacturers/marketers, by appliance.

12226 (DOE/CS/20335—T6) Analysis & critique of the proposed 1979 Market Facts, Inc. appliance survey. Final report. (Policy Planning and Evaluation, Inc., McLean, VA (USA)). Sep 1979. Contract AC01-79CS20335. 26p. NTIS, PC A03/MF A01. Order Number DE84005695.

Issues identified in the 1977 survey pertaining to sampling methodology are discussed. The sampling methodology for selecting households into the sample and the sampling methodology for selecting appliances for the Appliance Stock questions are discussed. The problems in the 1977 survey are presented first, followed by a description and analysis of the procedure to be used in the 1979 survey. A discussion of Trade-Off Analysis is presented. A description of the methodology as well as an example of how the results can be used is presented and then the use of trade-off analysis in the 1979 survey is discussed. A description of the method in which households and appliances are to be selected for the trade-off analysis is presented and next some of the expected types of results of the analysis are given. This section will close with a discussion of some of the issues in the use of conjoint analysis. The problems with the contingency table analysis performed on the results of the Appliance Usage questions in the 1977 survey are reviewed briefly and then the implications of the 1977 survey results for data analysis in the 1979 survey are discussed.

12227 (DOE/CS/24438—T1) Intergovernmental small business energy management demonstration program. Final technical report. (Fort Lauderdale City Manager's Office, FL (USA)). 31 Dec 1982. Contract FG01-80CS24438. 114p. NTIS, PC A06/MF A01. Order Number DE84005189.

Reduced use of over 12 billion Btu's and avoided costs exceeding $200,000 are the savings documented in a grant study that paired the administration and organization of the City of Fort Lauderdale, Florida, with eleven businesses in an energy conservation demonstration program. The businesses represent five business categories chosen because they were both energy intensive and prevalent in significant numbers in the community. Included in the group were three motels, two laundry/cleaning services, a hospital, a supermarket and four manufacturing firms. Each business was audited on-site for energy use by a team of City employees. Energy conservation measures and new energy-saving technologies were recommended. Savings were calculated comparing actual use in a base year to use in a test year.

12228 (DOE/CS/65001—T2) City experience with Institutional Buildings Grants Program. Final performance report. (US Conference of Mayors, Washington, DC). 1982. Contract FG01-80CS65001. 2p. NTIS, PC A02/MF A01. Order Number DE84005703.

The US Conference of Mayors contracted to undertake a series of studies identifying and describing mechanisms by which assistance under the Institutional Buildings Grants Program was being provided to a representative group of cities. The original work program called for selecting 10 cities in five states, examining state administration plans, and interviewing state and local program officials to establish differing patterns of program implementation. Particular attention was to be given to innovative and successful vehicles for achieving the objectives of energy conservation in municipal buildings.

12229 (DOE/R4/10453—T1) Wood furnace. Final technical report. Boggs, G.W.; Boggs, M. (Boggs (Glenn W.), Douglasville, GA (USA)). [nd]. Contract FG44-81R410453. 3p. NTIS, PC A02/MF A01. Order Number DE84000796.

The design and performance of wood furnace with a water filled heat exchanger are described briefly. (MHR)

12230 (DOE/R6/12081—T1) Development of a chemically assisted mechanical refrigeration cycle. Final report. Vobach, A.R. (Vobach (Arnold R.), Spring, TX (USA)). 20 Oct 1983. Contract FG46-81R612081. 35p. NTIS, PC A03/MF A01. Order Number DE84004962.

In its most basic version, the chemically assisted mechanical, CAM, refrigeration cycle operates as follows: A pressurized solution of refrigerant gas dissolved in a liquid solvent is introduced into an evaporator-effervescer, EE, where, at reduced pressure, the refrigerant effervesces, or boils, out of the solvent liquid. In so doing, it absorbs both the latent heat of vaporization and the heat of dilution (heat of dissolution, heat of disassociation, heat of mixing) required to disassociate it from the solvent. Vaporized refrigerant and pure solvent may then be separated (using an eliminator at the top of the EE if necessary) and the refrigerant is drawn to a compressor while the solvent is circulated to the condenser-mixer, CM. If appropriate, the refrigerant can be foamed with the solvent, and both can be circulated to the compressor together, eliminating the solvent pump. In fact, to achieve maximum cycle efficiency, the refrigerant gas should be compressed in the presence of the cool solvent, to achieve more nearly isothermal than isentropic compression. The compressed refrigerant gas is next mixed with and dissolved into the returned solvent in the CM. Here is given up the latent heat of condensation determined by the amount of gas entering the liquid phase and also the corresponding heat of mixing.

12231 (ERATL—83/33) Building services automation. (Re-announcement of ERATL-83/01--see notes field for explanation). Final report. Bull, R.G.; Baker, P.D.W. (ERA Technology Ltd., Leatherhead (UK)). Jul 1981. 302p. NTIS.

Automatic systems for controlling building services and energy management are becoming increasingly attractive to users of buildings of quite modest sizes and achieve remarkable pay-back periods averaging less than 15 months. The choice of systems available, usually based on microprocessor technology, is difficult for potential users. This report describes the main systems available and compares 35 case studies of users carefully selected to represent current UK practice. It describes the factors which affected their choice and analyses the benefits obtained compared with those expected.

12232 (ILLDOE—81/35) Residential and industrial energy conservation potential in Illinois, 1980 to 2000. Herendeen, R.; Jacobs, C.; Robinson, R. (Illinois Inst. of Natural Resources, Springfield (USA); Illinois Univ., Urbana (USA). Office of Vice Chancellor for Research). Sep 1981. 102p. Illinois Dept. of Energy and Natural Resources, Rm. 300, 325 W. Adams St., Springfield, IL 62670.

Illinois residential and industrial energy consumption for the period 1980 to 2000 is evaluated if a large number of cost-effective energy efficiency improvements are carried out, and compared with a baseline, a continuation of today's practice. This is a what if study; there is not an attempt to predict rates of adoption. Baseline results show increases of 10% and 3% for residences and industry, respectively, from 1980 to 2000. Adoption of energy efficiency improvements changes this to reductions of 37% and 13%, respectively. Most of the residential measures (more efficient appliances, thermal tightening of structures) are unambiguously cost-effective. This is less clear for industrial measures (industry uses a high discount

rate) and subsidies (via tax breaks) have been suggested to stimulate conservation.

12233 **(LBL—16366) Energy use in a high-rise apartment building. Progress report.** Lipschutz, R.D.; Diamond, R.C.; Sonderegger, R.C. (Lawrence Berkeley Lab., CA (USA)). Sep 1983. Contract AC03-76SF00098. 59p. NTIS, PC A04/MF A01. Order Number DE84005867.

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In June 1982, the Energy Performance of Buildings group of the Applied Science Division at Lawrence Berkeley Laboratory initiated a study in a 328-unit, 15-story high-rise apartment building in Oakland, California, to investigate energy use patterns in such a structure. The units are heated electrically and all have similar complements of electric appliances. Natural gas for domestic hot water and cooking is supplied through a common meter. Hence, it was possible to analyze the electric billing information to determine electricity use patterns. A 20 to 1 range was found in baseload electricity consumption and a 40 to 1 range for space heating in a sample of 207 units. Units with an eastern orientation used less electricity for space heating than did those facing other directions. Other technical features for which we were able to devise tests were found not to account for any part of the observed variation. The analysis suggests that some occupants may be using their gas ranges for space heating, although our results are not conclusive on this point. A second major cause of the variations may be differences in occupants' temperature preferences.

12234 **(LBL—16658) New residential building construction in the United States.** Levin, P. (Lawrence Berkeley Lab., CA (USA)). Sep 1983. Contract AC03-76SF00098. 43p. NTIS, PC A03/MF A01. Order Number DE84006266.

The information obtained, concerning new residential construction in the United States is summarized and important differences between US and Swedish technology and construction methods for energy-efficient housing are pointed out. Selected building components for US housing are described and compared with corresponding Swedish techniques. The most important differences are: differences in ventilation strategies (almost all new Swedish houses have continuous mechanical ventilation); the airtightness of building envelopes; and wall construction and standard insulation practices. There are energy-efficient US houses especially in the colder parts of the country, that have the same features as the most energy-efficient houses in Sweden, but the variations from standard construction are much greater in the United States.

12235 **(LBL—16770) Building envelope thermal and daylighting analysis in support of recommendations to upgrade ASHRAE/IES Standard 90. Final report.** Johnson, R.; Sullivan, R.; Nozaki, S.; Selkowitz, S.; Conner, C.; Arasteh, D. (Lawrence Berkeley Lab., CA (USA)). Sep 1983. Contract AC03-76SF00098. 100p. NTIS, PC A05/MF A01. Order Number DE84005869.

Fenestration design can greatly affect the energy requirements for space conditioning and electric lighting in buildings. The net annual effect greatly depends on the effectiveness of daylight utilization with specific results being a complex function of the interaction among building design features, building operating characteristics, and climate. The object of this study was to isolate the energy effects of fenestration and electric lighting design, quantify these effects, and develop simplified analysis tools for compliance use in the building envelopes section of ASHRAE/IES Standard 90. Envelope thermal conductivity, fenestration design, and electric lighting characteristics are parametrically varied through a wide range of values and in a diversity of climates. For these parametric variations, annual energy consumption is calculated with the DOE-2.1B energy analysis program. The numerical results are collected and stored on tape. From this data base statistical analysis is performed using multiple regression techniques leading to simplified correlation expressions characterize annual energy performance trends for cooling, heating, and cooling peak so that users can easily ascertain the energy implications of design options for fenestration, daylighting, and electric lighting.

12236 **(LBL—16813) Improving the energy efficiency of residential clothes dryers.** Hekmat, D.; Fisk, W.J. (Lawrence Berkeley Lab., CA (USA)). Jul 1983. Contract AC03-76SF00098. 79p. NTIS, PC A05/MF A01. Order Number DE84005861.

An experimental study on energy efficient electrical domestic clothes dryers is presented. A literature survey was performed and four basic energy saving techniques were identified: (1) reduced air flow rate and heater input, (2) recirculation of a portion of the exhaust air back into the clothes dryer, (3) heat recovery, utilizing an air-to-air heat exchanger, and (4) 100% recirculation of air through the dryer and a heat pump to condense water out of the air. Reduced air flow rate and heater input leads to energy savings around 8%, while recirculation of exhaust air reduces the energy consumption by approximately 18%. Because of the low cost of these two measures, they should be pursued by the manufacturers. When utilizing an air-to-air heat exchanger for heat recovery, two modes are considered. The first is to preheat the inlet air with heat from the exhaust air, which results in 20 to 26% energy savings depending upon the location of the dryer in the house. The second more attractive mode is 100% recirculation of air and condensation of water from this air in the heat exchanger (using indoor air as a heat sink) and represents a 100% heat recovery but leads to a 1 to 6% increase in energy consumption. The development of a clothes dryer equipped with an air-to-air heat exchanger and a summer/winter switch (preheating mode in the summer and recirculation/condenstion mode in the winter) should be pursued by the manufacturers. Recirculation through a heat pump with condensation again gives a 100% heat recovery and can save up to 33% in energy consumption but yields long drying times due to limitations of the condenser temperature.

12237 **(LBL—16925) Test, evaluation, and report on mercury enrichment for fluorescent lamps.** Maya, J.; Grossman, M.; Rider, D.; Lagushenko, R. (Lawrence Berkeley Lab., CA (USA)). Oct 1983. Contract AC03-76SF00098. 50p. NTIS, PC A03/MF A01. Order Number DE84005868.

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The effects of utilizing mercury enriched in ^{196}Hg on fluorescent lamp efficacy and operational characteristics and results of enrichment of ^{196}Hg via a photochemical reaction technique are summarized. The central theme of the lamp studies is the measurement of lumen efficacy and electrical operating points as a function of isotopic distribution within individual lamps. That is, test lamps are first run in natural mercury, then mercury containing ^{196}Hg is dispensed within the lamp. A comparison of the lamp operation before and after ^{196}Hg dispensing is made to find the effects of altered isotopic distribution on lamp operation. Two additional topics were briefly looked into, as indicated; effects of dc magnetic fields applied transverse to the lamp current flow and effects of high frequency lamp operation.

12238 **(NP—4770152) Energy conservation by employing heat pumps for space heating.** (Hessischer Minister des Innern, Weisbaden (Germany, F.R.). Referat fuer Oeffentlichkeitsarbeit). [nd]. 53p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84770152.

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Concerned about sufficient energy supply, the Parliament of Hesse proposed to offer information about types of drives and energy, possibilities to gain heat from air, water and soil to a greater public. Furthermore, explanations of the specific relation to public law of the measures that have to be discussed are intended to make planning and implementation easier for investors in heat pumps. To complete the subject, the necessary attention is given to the assistance from public means, so that the investor is able to get an idea as comprehensive as possible of the employment of heat pumps, of its possibilities and its limits.

12239 **(ORNL/Sub—78-7559/5) Problems associated with the use of urea-formaldehyde foams for residential insulation. Part V. Effects of UFFI additives on formaldehyde emission and physical characteristics of the foam.** Scarpellino, C.D.; Sailer, S.J.; Schutte, W.C.; Frank, C.W.; Long, K.R. (Oak Ridge National Lab., TN (USA)). Dec 1983. Contract W-7405-ENG-26. 39p. NTIS, PC A03/MF A01. Order Number DE84004129.

This study is a continuation of earlier work related to the effects of temperature and humidity of UFFI. Special emphasis is placed on additives that alter the chemical and physical properties of this insulation project.

12240 **(ORNL/Sub—79-24712/2) Advanced electric heat pump component development and evaluation. Interim report.** Veyo, S.E. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Research and Development Center). 10 Sep 1982. Contract W-7405-ENG-26. 213p. NTIS, PC A10/MF A01. Order Number DE84006095.

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This report documents the Westinghouse effort to October, 1981 toward the development of an advanced electric heat pump 20 percent more efficient than the most efficient unit available in early 1979. The Westinghouse/DOE advanced heat pump will exceed the efficiency of a 1979 model high efficiency two-speed heat pump by 20 percent or more on an annual basis in all but the most southern regions of the continental United States. In colder regions, typified by Minneapolis or Pittsburgh, the estimated efficiency improvement is greater still. This performance is due in part to the development of a high efficiency reciprocating compressor with dual-capacity modulation by stroke change. The efficiency of this compressor exceeds the best currently available. Additional system improvement stems from the development of a microprocessor-based control system plus indoor and outdoor air movers that reduce air moving power by approximately half, relative to the state-of-the-art. Estimated system performance is given along with development details and measured performance for the major components (compressor, heat exchanger, fan, blower, motors).

12241 **(PB—83-239848) Thermal conductivity of moist materials: proposals for test methods.** Sandberg, I. (Statens Provningsanstalt, Boraes (Sweden)). 1982. 50p. NTIS, PC E04/MF E01.

The present report constitutes the first subreport on a major project, aiming at developing suitable methods for determination of the way in which moisture affects the heat-insulating capacity of building materials. It has been known for a long time that moisture in thermal insulation materials impairs the heat-insulating capacity of the material. The available information is, however, in many cases insufficient or contradictory. This is due to the fact that many different methods of measurement have been used, and that results sometimes are interpreted wrongly. The thermodynamic processes in testing moist materials are very complicated, and the concept of thermal conductivity of moist materials may be interpreted in different ways. The problem of determining the effect of moisture on thermal conductivity is twofold: determination of the moisture contents encountered in practice in different building sections; determination of the way in which a given moisture content affects the thermal conductivity. The present project deals only with the latter problem.

12242 **(PB—83-251082) Identification and ranking of transportation cost reductions through energy conservation strategies. Final report, 1 September 1981-1 December 1983.** Yu, J.C.; Pang, L.M.G. (Utah Univ., Salt Lake City (USA). Dept. of Civil Engineering). Jan 1983. 233p. NTIS, PC A11/MF A01.

For many urban transportation agencies, energy conservation is one of the important goals in the development of their respective transportation programs. This report develops a comprehensive transportation energy conservation (TEC) program within an urban environment.

12243 **(PB—83-253948) Low-sloped roofing research plan. Final report.** Cullen, W.C.; Rossiter, W.J. Jr; Mathey, R.G.; Clifton, J.R. (National Bureau of Standards, Washington, DC (USA). Center for Building Technology). Jul 1983. 44p. NTIS, PC A03/MF A01.

This report presents a long-range plan for roofing research. The plan was developed in response to a need for roofing research addressing major materials problems and changes in low-sloped roofing materials technology. The intent of the plan is to establish the technical basis for developing standards and minimum levels of performance to assist in the selection of cost-effective and durable roofing materials. Four major areas of needed research are identified: low-sloped roofing systems, roofing membranes including single-ply and built-up, thermal insulation for roofing systems, and condition assessment and repair of roofs. Within each research area, a goal is given as well as a number of objectives to achieve the goal. A recommended approach to accomplish each objective is also given.

12244 **(PB—83-259622) Building technology project summaries 1982-1983.** Raufaste, N.; Olmert, M. (National Bureau of Standards, Washington, DC (USA). Center for Building Technology). Jun 1983. 140p. NTIS, PC A07/MF A01.

The Center for Building Technology specialized laboratory facilities and equipment located at Gaithersburg, Maryland, have a replacement value estimated at $20 million. Among the variety of special facilities and equipment are the universal testing machine with a 12-million-pound capacity; a reaction wall for subjecting full-scale building systems to earthquake loading; seven environmental chambers, including a 30 x 40 x 60 ft chamber, for evaluating the thermal performance of buildings and components; a line heat source guarded hot-plate to characterize insulation to 12 inches thick; a calibrated hot-box test facility; a five-story plumbing research laboratory; reverberation and anechoic chambers; lighting research facilities; mobile laboratories; an outdoor solar-collector test-method development area, including a passive solar test house; a network of outdoor exposure sites; a scanning electron microscope and other instruments for material characterization; facilities for experiments on solar heating and cooling systems; and controls and equipment laboratories. This report summarizes CBT's research for 1982-1983.

12245 **(PB—84-114586) Residents and windows. 1. Shielding of windows.** Lyrberg, M.D. (Statens Inst. foer Byggnadsforskning, Stockholm (Sweden)). Jun 1983. 21p. NTIS, PC E03/MF E01.

In order to assess the influence of the shielding of windows performed by occupants in residential buildings on the heat balance of the building, the shielding of 40,000 windows was determined by observation during two heating seasons. It is shown that the demand for privacy has a large effect on the degree of window-shielding. There are also indications that many occupants trying to save energy use window-shielding as one of their means to achieve this.

12246 **(PB—84-114958) Volets roulants pour habitations (Roller blinds for dwellings).** (Centre Scientifique et Technique de la Construction, Brussels (Belgium)). Oct 1982. 54p. NTIS, PC E05/MF E05.

The contents are: Definition and function of roller blinds; types of roller blinds (plastic, wood, aluminum); Constituent elements of a roller blind: the blind, lateral guide rails, opening systems, roller casing; Systems preventing intrusion; The use of roller blinds in renovation; and thermal insulation of roller blinds.

12247 **Assessment of seasonal efficiency models for natural-gas-fired residential furnaces.** Domingo, N. (Oak Ridge National Lab., TN); Keshock, E.G. pp 404-405 of 5th Miami international conference on alternative energy sources. Vezirogla, T.N. (ed.). Coral Gables, FL; Univ. of Miami (1983). (CONF-821213—). Contract W-7405-ENG-26.

From 5. international conference on alternative energy source; Miami Beach, FL, USA (13 Dec 1982).

12248 **Wind data for natural ventilation systems analysis.** Robbins, C.L.; Hunter, K.C. (Solar Energy Research Inst., Golden, CO). pp 889-892 of Progress in passive solar energy systems. Hayes, J.; Winn, C.B. (eds.). New York, NY; American Solar Energy Society (1982). (CONF-820819—).

From 7. national passive solar conference; Knoxville, TN, USA (30 Aug 1982).

Natural ventilation systems can be grouped into three categories: velocity-induced ventilation, temperature-induced ventilation, and combined velocity- and temperature-induced systems. This paper presents a methodology to provide wind data useful for designing and analyzing velocity-induced natural ventilation systems in buildings. Data are provided in three formats: average and mean hourly wind speed and direction, annual bin wind data, and monthly bin wind data.

12249 **Passive solar design concepts applied to multi-family construction.** Fitts, R.J. (The Design Collaborative, Virginia Beach, VA). pp 555-558 of Progress in passive solar energy systems. Hayes, J.; Winn, C.B. (eds.). New York, NY; American Solar Energy Society (1982). (CONF-820819—). Contract AC02-79CS30166.

From 7. national passive solar conference; Knoxville, TN, USA (30 Aug 1982).

The objective of this project is to redesign a speculative, townhouse-for-sale project to include justifiable energy conserving/passive solar features. The major focus of this project was in identifying and justifying energy conserving/passive solar features which would meet all the criteria that a volume speculative home builder faces. We evaluated over 50 energy conserving/passive solar features which are applicable to low-cost spec-built residential projects. We selected 19 features which met the builder/developer's criteria. Energy use was reduced 25% to 50%. Instant payback plus low initial cost was achieved. Energy savings exceeded extra mortgage costs, even at mortgage rates up to about 20%. Initial selling prices were raised only $1,158 (about a 3% increase).

3202 Transportation

REFER ALSO TO CITATION(S) 12170, 12302, 12303, 12313, 12336

12250 **(AD-A—133629/6) Investigation of the commercial alternative power sources for the counterbalanced industrial lift truck. Final report.** Stephens, J.E. Jr; Lee, T.F. (Army Mobility Equipment Research and Development Center, Fort Belvoir, VA (USA)). Oct 1982. 142p. (MERADCOM—2369). NTIS, PC A07/MF A01.

A comparative analysis of four different power sources (gasoline, liquid petroleum gas (LPG), diesel, electric) for 4,000-lb capacity forklift trucks was made for productivity, exhaust emission characteristics, noise levels, energy consumption, reliability, maintainability, operating costs, and safety ramifications. The principal Conclusions reached were: (1) Internal combustion engine (ICE) trucks are more productive than are electric; (2) Diesel was most productive truck; (3) Electric truck was most economical considering only energy costs (diesel was second); (4) All trucks except electric exceeded accepted noise standard; (5) Diesel truck emitted significantly less carbon monoxide (CO) than did gasoline or LGP.

12251 **(DOE/CS/20335—T4) Review of Department of Transportation regulatory procedure (average fuel economy standards program). Final report.** (Policy Planning and Evaluation, Inc., McLean, VA (USA)). Oct 1979. Contract AC01-79CS20335. 75p. NTIS, PC A04/MF A01. Order Number DE84005689.

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The Energy Policy and Conservation Act of 1975 required the Secretary of Transportation to establish energy efficiency standards for automobiles manufactured during 1981-1984 model years. The development of standards necessitated: development of an appropriate organizational structural within DOT (which was able to generate new information and use the results of existing Federal programs for automobiles); development of methodologies to determine technological feasibility and economic practicability; and collection and evaluation of large scale engineering, manufacturing, financial and economic data. The organizational structure, methodologies used to determine technological feasibility, and economic practicability are described. The data collected by the DOT in order to propose and finalize the standards are described. In addition, the procedures used to collect information from automobile manufacturers are described.

12252 **(DOE/CS/56051—9) Availability of No. 6 fuel oil and potential for blending with No. 2 diesel fuel to serve medium-speed diesel marine/rail markets.** (Mueller Associates, Inc., Baltimore, MD (USA)). Dec 1983. Contract AC05-79CS56051. 31p. NTIS, PC A03/MF A01. Order Number DE84005872.

This report assesses the potential availability of No. 6 fuel oil for use as a blending component with diesel fuel to serve potential rail and marine medium-speed diesel markets. The potential demand for the fuel was estimated by assuming three penetration rates of the diesel fuel rail and marine markets. Results show that although the demand for No. 6 fuel oil as a blending component will not be significant, its new total demand will be higher than the estimated future supply of the fuel. Since the production of No. 6 fuel oil is expected to decrease between 1985 and 1990, any differences between demand and production must be met by imports. Any increases in fuel demand therefore, will require increased imports making the United States less self-reliant.

12253 **(DOE/R4/10309—T1) Sail-powered commercial fishing vessel. Final technical report.** Sorensen, D.E. (Sorensen (Donald E.), Port Richey, FL (USA)). 15 Jan 1982. Contract FG44-80R410309. 7p. NTIS, PC A02/MF A01. Order Number DE84000322.

Experiences in obtaining materials for the vessel are reviewed. The time traveling to and from the fishing grounds is 2 to 4 hours longer than with a powered vessel. (MHR)

12254 **(PB—83-239616) I-35w incident management and impact of incidents on freeway operations. Final report, 1976-1979.** Lari, A.; Christianson, D.; Porter, S. (Minnesota Dept. of Transportation, Minneapolis (USA). Traffic Management Center). Jan 1982. 61p. NTIS, PC A04/MF A01.

I-35W and I-94 Traffic Management System have been in operation since 1974. As of December 1979, the TMS operation included six principal functional subsystems. These are (1) a 24 camera closed circuit television network (2) 38 ramp meter signals, (3) eleven express bus and/or carpool meter bypass ramps, (4) a motorist information program including changeable message signs, lane control signals, highway advisory radio and a traffic grade information sign, (5) the Traffic Management Center and (6) an incident detection and response program. The purpose of this study was twofold: first, available incident records accumulated on the TMS were analyzed to develop a comprehensive view of the types and quantities of incidents that have occurred. Second, the incident data base and companion volume and occupancy data was used to determine the impact of 'typical' incidents and the impact of the total incident problem. Included in the report is an analysis of incident types detected, mode of incident detection, duration of incidents, and incident response activities.

12255 **(PB—83-251074) Identification and ranking of transportation cost reductions through energy conservation strategies. Executive summary. Final report, 1 September 1981-1 January 1983.** Yu, J.C.; Pang, L.M.G. (Utah Univ., Salt Lake City (USA). Dept. of Civil Engineering). Jan 1983. 9p. NTIS, PC A02/MF A01.

This report develops a comprehensive transportation energy conservation (TEC) program within an urban environment. The objectives of this research were to: (1) compile data on TEC strategies through a literature search and contacts with concerned agencies in the United States; (2) identify and assess impact measures relative to TEC strategies; (3) develop a cost-effectiveness methodology for evaluating and ranking the various TEC strategies under given situations; and (4) apply the developed methodology to real-world cases in order to demonstrate its usefulness and practicability.

12256 **(PB—84-117530) Transit car demonstration test program on the roll dynamics unit. Volume 1. State-of-the-art-car (SOAC) creep forces and dynamic response on the roll dynamics unit. Final report.** Cooperrider, N.K.; Law, E.H.; Fries, R.H.; Haque, I. (Federal Railroad Administration, Pueblo, CO (USA). Transportation Test Center). Sep 1982. 154p. NTIS, PC A08/MF A01.

This report documents two separate studies aimed at verifying and demonstrating the capabilities of the Roll Dynamics Unit (RDU), which is part of the Rail Dynamics Laboratory located at the Transportation Test Center (TTC) in Pueblo, Colorado. During testing, the RDU's potential for simulating actual track conditions was explored and results were correlated with measurements taken during in-track testing. Other efforts focused on the RDU's use as a laboratoy instrument by which selected performance parameters can be varied, and the responses of a single rail vehicle measured, under controlled conditions. Testing involved use of the Number One State-of-the-Art Car (SOAC), one of two such vehicles developed under UMTA's Urban Rail Vehicle and Systems Program (URRVS). The 90,000-pound intra-city, rapid transit vehicle, configured as an 'A' Car capable of independent or two-car operation, was tested on the TTC's Transit Test Track to provide in-track data. It was then installed on the RDU for the testing described. Information on SOAC technical/historical development and URRVS program highlights are presented as background for the discussion of the results.

12257 **(PB—84-117548) Transit car demonstration test program on the roll dynamics unit. Volume 2. Demonstration of a transit car performance test on the roll dynamic unit. Final report.** Arnold, G.; Nelson, S.; Cooperrider, N.K.; Law, E.H.; Fries, R.H. (Federal Railroad Administration, Pueblo, CO (USA). Transportation Test Center). 11 Feb 1982. 64p. NTIS, PC A04/MF A01.

This report, Volume II, contains the results, conclusions, and recommendations of the first performance test of a transit care on the RDU. This report is limited to performance tests. The objective is to identify advantages and disadvantages of performance testing on the rollers of the RDU as highlighted by the SOAC test. The report involved separate testing, done by TTC personnel, in such traditional performance areas of transit vehicle operation ass traction, acceleration/deceleration, energy consumption, and spin/slide performance. The results of the successful performance test of a transit car on a roller unit is presented and the advantages of this method of testing is discussed. Acceleration, deceleration, spin/slide, and power consumption tests, although of limited scope in comparison to the track tests performed on the same transit car, did show the feasibility of roller testing. It is concluded that the RDU is most suited for developmental testing of transit car systems particularly for power consumption and for cars with non-standard wheel gage. Tests should be of such scope as to justify the cost of car setup on the RDU. The following two test are recommended: (1) a power consumption study for a standard/non-standard gage transit car which investigates methods of reducing power consumption and (2) a non-standard gage full performance test.

3203 Industry And Agriculture

REFER ALSO TO CITATION(S) 11433, 11701, 12128, 12161, 12230, 12232, 12253, 12274, 12372, 12407

12258 **(AD-A—130878/2) Electric motor study to determine the optimum method for reducing electrical energy consumption at Lone Star Army Ammunition Plant. Final report Mar 1982-Mar 1983.** Caplinger, R.H.; Rose, A.; Hogan, R.E. (Day and Zimmerman, Inc., Texarkana, TX (USA)). Jun 1983. 27p. NTIS, PC A03/MF A01.

A large part of the cost of electricity at Lone Star Army Ammunition Plant (LSAAP) is attributed to the operation of electric motors used in the process operations. An electric motor study was conducted to determine the optimum method for reducing electrical energy consumption at LSAAP over the life-cycle of the equipment. An inventory was performed of all motors rated one-quarter horsepower and above. Of the 3566 motors inventoried, 1299 were active and 2267 were inactive. It was determined that the current electric motor replacement method is the most cost-effective and energy-efficient over the life-cycle of the equipment. Improvement in efficiency could be achieved by replacing, through attrition, motors that economically qualify with energy efficient motors. Few of the motors, when they do fail, qualify for economic replacement. In this study, no motors qualified for immediate replacement since the expected reduction in operating costs could not amortize the cost of a new motor in a reasonable length of time. Standardization of motors and efficiency improvement through the application of capacitors and power factor controllers were considered and determined not to be cost effective at this time.

12259 **(AD-A—131117/4) Energy conservation guide for industrial processes.** (Syska and Hennessy, New York (USA)). Jan 1981. 213p. NTIS, PC A10/MF A01.

Th Energy Conservation Guide for industrial processes has simple instructions to survey energy use areas at Navy industrial activities like shipyards, Naval air rework facilities and government owned, contractor operated (GOCO) plants. This guide includes information and procedures on: organizing and conducting an industrial energy survey; evaluating purchased energy data; descriptions of industrial systems; and evaluation of industrial processes for conservation.

12260 **(DOE/CS/15004—T1) Burrow's process for recovery of metallic values from smelter emissions. Progress report, April-June 1980.** Engel, C.D.; Fuller, C.E. (REMTECH, Inc., Huntsville, AL (USA)). 18 Jun 1980. Contract FG01-80CS15004. 10p. NTIS, PC A02/MF A01. Order Number DE84004394.

The investigations conducted to evaluate the engineering and economic viability of the Burrow's process for the recovery of metallic values from smelter emissions are summarized. The evaluations center around the development and use of a math model which will allow the study of parametric variations to determine the optimum process and plant configurations. The model will be validated with process data obtained in the laboratory and from planned plant tests. Other data that will be assimilated will involve energy, pollution, and marketing considerations. Details of the progress made to date are provided.

12261 **(DOE/CS/15004—T2) Final evaluation of Shelander-Burrows process for recovery of metallic values from smelter emissions.** Shelander, E.H. (Shelander (Edward H.), Brunswick, GA (USA)). 30 Jun 1982. Contract FG01-80CS15004. 58p. NTIS, PC A04/MF A01. Order Number DE84004393.

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It is computed that energy requirements to produce a ton of Burrows Process Fertilizer Grade zinc oxide is 1.5×10^6 Btu. J. Paul Pensler, in his report Second Stage Evaluation Report of Shelander-Burrows Process for Recovery of Metallic Values from Smelter Emissions prepared for the Office of Energy Related Inventions, National Bureau of Standards, dated December 5, 1978, paragraph 1.2, Zinc Oxide, states that energy requirements for French and American Process Zinc Oxide are 69×10^6 and 115×10^6 per ton respectively. This enormous conservation of energy is further enhanced by the added effect of co-production of about 100 pounds of copper and 200 pounds of lead per ton of raw dust.

12262 **(DOE/CS/40191—T2) Handbook for energy management of atmospheric cookers.** Pedersen, L.; Rose, W.; Nicholson, J. (National Food Processors Association, Berkeley, CA (USA)). [nd]. Contract AC07-78CS40191. 57p. NTIS, PC A04/MF A01. Order Number DE84005500.

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The scope of this book is to show the potential energy savings through lowering of cooker temperature and through various redesigns, such as vapor recycle, water recycle, steam locks, insulation, etc. and in a comprehensive form provide a procedure for the Food Processor to determine the individual savings potential and to select the most efficient mode of operation. There have been selected and discussed various tests which hopefully together with the more general theoretical background will aid the Food Processor in obtaining a more efficient atmospheric cooker operation.

12263 **(DOE/CS/90215—T1) High-temperature CVD heat pipe development. Final report.** (Thermo Electron Engineering Corp., Waltham, MA (USA)). Apr 1983. Contract AC02-81CS90215. 100p. NTIS, PC A05/MF A01. Order Number DE83017893.

Efforts to develop a High-Temperature Chemical Vapor Deposition Heat Pipe (HT CVD HP) are summarized. The detailed development of the CVD heat pipes is discussed including: construction of CVD reactors, construction of lithium charging station, refinement of burn-off procedure, CVD heat pipe development and fabrication, test results, and potential applications. (MHR)

12264 **(DOE/ID/12239—T1) Technical and economic feasibility of Stirling cycle industrial heat pumps. Final report.** (General Electric Co., Philadelphia, PA (USA). Advanced Energy Programs Dept.). Dec 1983. Contract AC07-82ID12239. 382p. NTIS MF A01. Order Number DE84005486.

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The results of a program to evaluate the technical and economic feasibility of Stirling cycle industrial heat pumps (SCIHP) are presented. The objective of the initial tasks of the program was to select four industrial processes and four Stirling cycle industrial heat pump concepts for detailed evaluation. Over 16 industrial heat pump concepts were considered in the evaluation. Performance and cost calculations were prepared for 33 industrial process/thermodynamic cycle combinations and over 12 mechanical configurations were evaluated for their reliability, maintainability, development risk and product characteristics.

12265 **(JPL-PUB—83-74) Survey of gas-side fouling in industrial heat-transfer equipment. Final report.** Marner, W.J.; Suitor, J.W. (Jet Propulsion Lab., Pasadena, CA (USA)). Nov 1983. Contract AC06-76RL01830. 166p. NTIS, PC A08/MF A01. Order Number DE84005611.

The results of a survey of gas-side fouling in industrial heat-transfer equipment are presented. Information for this study was obtained through personal contacts, visits to selected industries, attendance at several professional meetings and conferences, and publications in the open literature. Gas-side fouling and corrosion problems occur in all of the energy intensive industries including the chemical, petroleum, primary metals, pulp and paper, glass, cement, foodstuffs, and textile industries. Topics of major interest in this study include: (1) heat exchanger design procedures for gas-side fouling service, (2) gas-side fouling factors which are presently available, (3) startup and shutdown procedures used to minimize the effects of gas-side fouling, (4) gas-side fouling prevention, mitigation, and accommodation techniques, (5) economic impact of gas-side fouling on capital costs, maintenance costs, loss of production, and energy losses, and (6) miscellaneous considerations related to gas-side fouling. The present state-of-the-art for industrial gas-side fouling is summarized by a list of recommendations for further work in this area.

12266 **(PB—83-258657) Comparison of alternative manure management systems: effect on the environment, total energy requirement, nutrient conservation, contribution to corn silage production and economics. Final report.** Martin, R.O.; Matthews, D.L. (Agway, Inc., Syracuse, NY (USA). Research and Development Dept.). Sep 1983. 167p. NTIS, PC A08/MF A01.

This study compares alternative dairy manure management systems operated under full scale commercial conditions. The study investigates weight of manure handled per cow per year, labor and energy requirements, effect on the environment, nutrient conservation, corn silage production and total annual operating costs. The dairy production facility used was a confinement stall barn at the Agway Farm Research Center, Tully, New York. Provisions were made to handle the manure from the barn in three ways: (1) directly into a spreader for daily spreading, (2) by gravity into a liquid manure storage tank for spring application and immediate plow down, (3) hydraulic ram to a roof-covered above-ground manure storage for spring and fall spreading. Results of the study show that a manure storage system can reduce annual labor requirements by 65 percent and fuel requirement by 60 percent or more, compared to daily spreading.

12267 **(PB—83-259879) Waste plastics and their potential for recycle.** Burlace, C.J.; Whalley, L. (Warren Spring Lab., Stevenage (UK)). [nd]. 17p. NTIS, PC E03/MF E03.

Recycling of waste plastics is reviewed. The available statistics on plastics waste arisings are presented and methods which have been developed for their reclamation are discussed. Some 150,000 tonnes/annum of mixed and contaminated polymer waste arise from industrial sources. It is suggested that further attention should be paid to techniques for cleaning and separating these wastes into their component polymers for subsequent re-use. (Copyright (c) Crown Copyright 1977.)

12268 **(PB—83-260323) Modelling of vat, heap, dump and in-situ leaching systems.** Whittemore, R.G. (Warren Spring Lab., Stevenage (UK)). [nd]. 101p. NTIS, PC E07/MF E07.

An estimated 206000 tons of copper are discarded annually in old scrap in the UK, of which 106000 tons are recovered at the present time. The locations of 90000 t of the unrecovered copper are identified. Predictions show that the amount of old copper scrap will increase to around 235000 tons per year (t/y) by the mid 1980s and that the quantity which is unrecovered may also increase disproportionally because a greater proportion of old scrap will be contained in products which are uneconomic to dismantle fully. UK consumption of copper scrap is forecast to increase by about 30000-40000 t/y by 1985, mainly because of potentially higher consumption by direct users of scrap. (Copyright (c) Crown Copyright 1979.)

12269 **Comparison of alternative cogeneration power systems for three industrial sites.** Harper, A.D. (Garrett Turbine Engine Company, Phoenix, AZ). *American Society of Mechanical Engineers, [Paper]*; **83-GT-173**: 6(1983). (CONF-830309—).

From 28. ASME international gas turbine conference; Phoenix, AZ, USA (27 Mar 1983).

Three alternative on-site cogeneration power systems were evaluated against technical and economic criteria for three industrial sites. Technical factors included plant sizing to meet process thermal loads, fuel utilization, power output, siting consideration, fuel savings, etc. Economic factors included capital cost, return on equity, and ownership/financing options among others. Each cogeneration plant was evaluated by comparison with the current separate generation scheme. The technologies considered were conventional coal-fired, steam topping cycles; coal-fired, atmospheric fluidized bed/closed-cycle gas turbines; and coal-fired, atmospheric fluidized bed/open cycle gas turbines. These approaches were optimized for three sites: an agricultural chemical plant, a brewery, and a kraft paper mill. The results showed that the closed cycle gas turbines yielded the best economics, primarily due to a lower initial cost. The open cycle gas turbine, when combined with a steam bottoming cycle, resulted in larger power outputs than would be realized in the closed cycle or steam turbine cases. None of the plants studied matched the plant electrical load while following the thermal load.

12270 **Method for the recovery of silver from waste photographic fixer solutions.** Posey, F.A.; Palko, A.A. US Patent Application 6-449,312. [nd]. 16p. Contract W-7405-ENG-26.

The method of the present invention is directed to the recovery of silver from spent photographic fixer solutions and for providing an effluent essentially silver-free that is suitable for discharge into commercial sewage systems. The present method involves the steps of introducing the spent photographic fixer solution into an alkaline hypochlorite solution. The oxidizing conditions of the alkaline hypochlorite solution are maintained during the addition of the fixer solution so that the silver ion complexing agents of thiosulfate and sulfite ions are effectively destroyed. Hydrazine monohydrate is then added to the oxidizing solution to form a reducing solution to effect the formation of a precipitate of silver which can be readily removed by filtration of decanting. Experimental tests indicate that greater than 99.99% of the original silver in the spent photographic fixer can be efficiently removed by practicing the present method. Also, the chemical and biological

oxygen demand of the remaining effluent is significantly reduced so as to permit the discharge thereof into sewage systems at levels in compliance with federal and state environmental standards.

3206 Municipalities And Community Systems

REFER ALSO TO CITATION(S) 11683, 11717, 11858, 11861, 12267

12271 **(DOE/CS/24321—T1) Program to develop MSW fired fluidized bed boiler. Final report.** Goldbach, G.; Wilson, K.; Trimble, M.; Prudhomme, J. (Combustion Power Co., Inc., Menlo Park, CA (USA)). Jun 1983. Contract AC03-80CS24321. 242p. NTIS, PC A11/MF A01. Order Number DE84005097.

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Combustion Power Company conducted a study of fluidized bed municipal solid waste (MSW) combustion for the purpose of assessing the technical and economic viability of the non-adiabatic fluid bed boiler in this service. The program, which consisted of mathematical process modeling, pilot testing, design studies and economic analyses, showed that an MSW-fired fluid bed boiler in the size range suitable for disposal of the solid wastes generated by a medium-sized city would cost under $100,000/million (37,000/TPD as burned MSW) in capital outlay and less than $6/million (51.1/ton $ as burned MSW) in yearly owning and operating (annualized) expenditures.

12272 **(DOE/RA/50314—T1) I-95 sanitary landfill gas recovery and utilization feasibility study.** (SCS Engineers, Inc., Reston, VA (USA)). 27 Aug 1982. Contract FG01-80RA50314. 202p. NTIS, PC A10/MF A01. Order Number DE84005360.

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This feasibility study was designed to determine the viability of a landfill gas (LFG) recovery and utilization system at the I-95 Sanitary Landfill. Specific objectives included estimating the quantity and quality of recoverable LFG, evaluating alternatives for LFG use, developing a phased LFG recovery program, and assessing the environmental, health, safety, and socio-economic impacts of such a program.

12273 **(NP—4770075) Probabilistic load flow calculations.** (Technische Univ., Vienna (Austria). Inst. fuer Elektrische Anlagen und Hochspannungstechnik). 1980. 56p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84770075.

A method is presented for the calculation of load flows in the case of undetermined node power values. These values are given by probability distributions to calculate the unknown parameters. The methods which have been puplished so far are described and discussed in brief, and a procedure is presented to account for the active power balance in the probabilistic calculation of load flows. The efficiency of this method is demonstrated by a numerical example.

12274 **(PB—83-238808) Emissions characteristics of cooling towers using reclaimed wastewater in california. Final report, July 1979-July 1981.** Rogozen, M.B.; Phillips, A.R.; Guttman, M.A.; Shokes, R.F.; Fargo, L. (Science Applications, Inc., Los Angeles, CA (USA)). 11 Aug 1981. 325p. NTIS, PC A14/MF A01.

Present and planned use of reclaimed municipal wastewater, industrial process water, and geothermal condensate as makeup to cooling towers have raised questions about the potential for atmospheric emissions of pathogenic microorganisms, organic compounds, heavy metals, and other wastewater constituents. In this study, the makeup and circulating water of six towers were sampled and analyzed for indicator bacteria and virus, volatile and nonvolatile organic compounds, metals, and other components of potential concern. Further water sampling and exhaust air emissions tests were then conducted on four of the towers; for the microbiological emissions tests, a special isokinetic sampling device was developed and employed.

12275 **(PB—83-240408) Potential for using alternative energy technologies in group central heating systems in Sweden.** Olsson, S. (Statens Raad foer Byggnadsforskning, Stockholm (Sweden)). 1983. 138p. NTIS, PC E07/MF E01.

The purpose of this study is to provide a description of the stock of Swedish group centrals and to determine the different factors which must be taken into account when considering alternative energy technologies in existing group centrals. This work is part of a larger effort that should eventually lead to an evaluation of the potential for using alternative energy sources in group central heating systems.

12276 **(PB—83-250670) Resource recovery planning model: a new tool for solid waste management. Final report.** Chapman, R.E.; Berman, E.B. (National Bureau of Standards, Washington, DC (USA). Center for Building Technology). Jul 1983. 202p. NTIS, PC A10/MF A01.

The Resource Recovery Planning (RRPLAN) model is designed with three purposes in mind. First and foremost, is the ability to generate a preferred plan for resource recovery. Second is the capability to evaluate a scenario specified by the decision maker for technical and economic feasibility. Third is its use as a tool to facilitate the decision making process by providing answers to many what-if questions through an in-depth sensitivity analysis. This report presents a non-technical discussion of the RRPLAN model. The basic philosophy behind the model is one of optimization. This approach was taken because it permits the economic and engineering data associated with the problem (e.g., waste generation rates and the location of processing facilities) to be organized in an objective manner. Although the model can focus on energy as its main objective, the minimization of the costs of processing a region's solid waste stream is believed to be the objective most often emphasized by decision makers. An example based on this objective is critically analyzed and used to illustrate how the model would be applied in practice.

12277 **(PB—83-255281) District heating/cooling feasibility, City of Devils Lake, North Dakota. Final report, 1981-1982.** Moen, C.; Zaiser, S.L. (Devils Lake Steam Heat Authority, ND (USA); Engineer-Architects, Grand Forks, ND (USA)). Nov 1982. 144p. NTIS, PC A07/MF A01.

The City of Devils Lake took over the operation of a district heating system originally built and operated by the Otter Tail Power Company. This was a steam system with heat supplied with cogeneration from the production of electricity. The system was small, but the engineering was good, it used a two pipe, return condensate system. It was originally designed to burn coal as fuel, it was later converted to oil, and then to natural gas. Most of the business district, a number of institutions, and public housing buildings were carried by the district heating system. The search for less expensive fuel included solid waste, but the amount was insufficient to carry through the cold winters. Agricultural waste in the form of durum wheat straw is available in abundance. Tests have shown that pound for pound the straw had a higher BTU content than local coal. Contracts have been made with local farmers to deliver straw bales or rolls at prices attractive to both parties. The system is now operating.

12278 **(PB—83-255307) City of Allentown, assessment of a district heating system. Final report, 1981-1982.** Oliker, I.; Tamayne, T. (Allentown Community Development Dept., PA (USA); Burns and Roe, Inc., Oradell, NJ (USA)). Sep 1982. 140p. NTIS, PC A07/MF A01.

The City of Allentown has designed a district heating system in three separate parts. Two of these will serve the central business district with high temperature hot water using natural gas as the fuel source. A large industrial area needing process steam will be served from another plant 50 MWe (37.5 MWt) cogenerating fluidized bed combustion units. It will occupy the site of a former waste incinerator and will use western Pennsylvania coal as fuel. The construction is phased to cover the period from 1983 to 1991, and is able to provide a substantial number of new jobs while reducing consumer costs for heat. Although a solid waste to energy incinerator at first seemed to be a good source of heat and an assist in waste disposal now using a remote location for sanitary land-fill,

the idea was abandoned in the face of opposition to a perceived problem in air pollution from its emissions.

12279 **(PB—83-255737) Assessment of feasibility of a district heating and cooling system for Ecorse, Michigan. Final report, 1981-1982.** Hock, M.J.; Cason, D. Jr. (Downriver Community Conference, Wyandotte, MI (USA)). Oct 1982. 63p. NTIS, PC A04/MF A01.

The City of Ecorse is an older industrial suburb of Detroit with an economy much related to the automobile industry. Ecorse conducted an assessment of the feasibility of building a district heating system which would service an 80 acre redevelopment area in the heart of the community. The system would utilize waste heat in the form of hot water from either of two electric generating plants, or a steel mill, or a nearby chemical plant located within the city. The estimated price of cogenerated thermal energy from one of the power plants was quite competitive. However, the 1980-1985 economy of Ecorse was so weak that the study found no real customer base for the heat in the target redevelopment area.

12280 **(PB—83-255893) District heating and cooling feasibility study, the City of Cambridge (Massachusetts). Final report, 1981-1982.** Aalto, P.; Timmerman, R. (Cambridge Community Development Dept., MA (USA); Pequod Associates, Inc., Boston, MA (USA)). Jul 1982. 168p. NTIS, PC A08/MF A01.

The City of Cambridge compiled data related to the market for a continued or expanded DHC system. This would build upon existing systems in the City, principally that of the Cambridge Steam Corporation. The study examined various cost alternatives to determine the competitive level which would assure market penetration. It includes an examination of technical issues relating to the existing DHC systems and an investigation of developer receptiveness to DHC. The study also includes an analysis of relevant utility regulations and a synthesis of the component costs of a DHC system. Cambridge's study concluded that cost allocation changes to reflect the true cost of steam would be necessary to assure viability of a DHC system based on the existing system. It recommended efforts with the Department of Public Utilities of Massachusetts to develop a more equitable cost allocation methodology. It also concluded that waste to energy conversion had potential as a heat source for a DHC system. It recommended a more detailed feasibility study to consider these issues in greater detail.

12281 **(PB—83-255901) Assessment of district heating/cooling system potential in Provo City, Utah. Final report, 1981-1982.** Limburg, G.; Kelly, P.; Hoskins, R.; Corlett, R. (Provo Office of Community Development, UT (USA)). Aug 1983. 128p. NTIS, PC A07/MF A01.

Provo, Utah owns and operates its electric utility system. The plant is lacking in modern emission controls and is therefore operated at a level of much less than full capacity. Power is purchased from the Utah P and L at wholesale and distributed throughout the city system. The city plant is valuable for peak shaving and standby purposes. Provo's climate experiences extremes of both heat and cold. There are many large heat users as: Brigham Young University, Utah Valley Hospital, the high school, city, county, and federal buildings as well as commercial and industrial users. An elderly housing project recently completed is furnished hot water heat from the city plant. Provo has several alternative heat source possibilities. Better emission controls could be added to the existing boilers to deliver more electricity and heat, a new fluidized bed coal fired boiler and generator could be built, cogenerating district heating by steam or hot water, a waste to energy incinerator has possibilities.

12282 **(PB—83-255919) Solid waste energy recovery project, Galax, Virginia: feasibility analysis. Final report, 1981-1982.** Blevins, D.W.; Pressing, A.R. (Lewiston Dept. of Development, ME (USA); Dewberry and Davis, Marion, VA (USA)). Sep 1982. 53p. NTIS, PC A04/MF A01.

The City of Galax, VA - 1980 population 6524 is located in the southwest part of the state on the border of Grayson and Carroll counties, and is the largest city in either. Galax is an employment and trading center with several furniture, textile, and food processing plants; it draws workers from the rural areas of both counties as well as from the city itself. The largest single employer is the Hanes Knitwear Corp. with 1200 jobs. The plant uses large quantities of process steam as well as for space heating. The plan devised will erect a 50 ton per day trash burning facility near Hanes, which will supply about 80% of the steam needed. The back-up to the system will be the oil burning boilers which will be on standby. There is no natural gas service in Galax. At some later date when the quantity of solid waste has increased or the wasteshed enlarged, another waste to energy facility could be built which would supply other industries, the CDB, the high school, and the Twin County Hospital.

12283 **(PB—83-255927) District heating/cogeneration, feasibility study, City of Lewiston, Maine. Final report, 1981-1982.** Faunce, R.; Goldschmid, T.; Wallace, C.; Katter, L.B.; Wade, D. (Lewiston Dept. of Development, ME (USA)). Sep 1982. 302p. NTIS, PC A14/MF A01.

The city's nineteenth century mill area remains functional and competitive, although at a disadvantage because of high energy costs. Lewiston's mill area is compact and serviced by a mill canal system. To some extent a district heating system exists at present and there is a tradition of cooperation in such efforts. The canal system offers opportunities for an expanded distribution system and for waste heat storage. Lewiston has identified a proposed service area consisting of a ring of industrial uses surrounding a mixed residential/commercial neighborhood. It has studied heat and steam demand and sources, such as gas, oil, coal, and wood pellets, and has identified municipal solid waste and wood waste as the best potential sources.

12284 **(PB—83-255935) District heating/cooling project assessment, Norwalk, Connecticut. Final report, 1981-1982.** Rodin, H.A.; Diskant, W. (Norwalk, City of, CT (USA)). Aug 1982. 207p. NTIS, PC A10/MF A01.

The City of Norwalk faced with continuing high costs of hauling solid wastes over 30 miles to a sanitary landfill became interested in a waste to energy plant. It surveyed possible heat users and determined that demand for heat would utilize all the heat generated from the volume of municipal solid waste (MSW). It is also possible that the nearby towns of Darien and Westport would find it in their interests to deliver their MSW to Norwalk. King Industries and a local hospital would provide anchor base loads, the price of heat delivered is to be calculated at 80% of cost now paid for fossil fuel. The hospital boilers would be retained for peak loading and stand-by purposes. A hybrid boiler system would produce steam at 150 lbs. for the King Industries and the hospital, to avoid retrofit costs, and hot water would be supplied to other buildings including new buildings to be erected after 1985. A back pressure generator will be installed in the steam line to generate the electricity needed to operate the plant with possible sales of excess to a local utility under PURPA.

12285 **(PB—83-255943) Technical and economic feasibility study for district heating in Springfield, Massachusetts. Final report, 1981-1982.** Oliker, I.; Tamayne, T. (Springfield Dept. of Public Works, MA (USA); Burns and Roe, Inc., Oradell, NJ (USA)). Dec 1982. 150p. NTIS, PC A07/MF A01.

Springfield made a study to assess the characteristics of a potential district heating and cooling service area and nine potential energy sources. It developed a conceptual transmission and distribution system, formulated a strategy for system development, quantified financial and environmental characteristics, and assessed institutional issues. The selected service area consists of 1,200 downtown acres with a peak connectable thermal demand of 98.64 MWT or approximately 337 million BTU per hour. The selected major energy sources are the existing West Springfield generating station, modified for district heat, new gas fired hot water generators, and a refuse fueled cogenerating plant. The city has mapped out a ten year system development strategy. The system would be a substantial boon for Springfield's downtown area, which is emerging from a long period of decline.

12286 **(PB—83-255950) Missoula Montana district heating/cooling assessment. Final report, 1981-1982.** Hubbell, M.; Barton, M. (Missoula Planning Office, MT (USA). Dept. of Community Development). Sep 1982. 99p. NTIS, PC A05/MF A01.

The city of Missoula has numerous heat users, three hospitals, many commercial structures, 13 schools and several public buildings. Unfortunately, no substantial sources of waste heat could be located. Montana coal is low in sulphur, and not expensive, but its use is restricted and discouraged because of the air pollution problem. There is a considerable amount of wood slash available, a pelletized product called 'Woodex' is locally made. This held some promise but it has not been produced in sufficient quantities nor is it likely to be economic in any near future. The conclusion of the assessment was that in the absence of a satisfactory heat source or fuel, the construction of a district heating system could not be justified in either economic or environmental grounds.

12287 **(PB—83-255976) District heating/cooling potential in New York City. phase 1. Final report.** McLoughlin, G.T.; Kuo, R.P.; Karol, J. (New York City Energy Office (USA)). Feb 1983. 117p. NTIS, PC A06/MF A01.

New York City through its Energy Office has identified and evaluated the technical and economic feasibility of district heating and cooling at three locations: Brooklyn Navy Yard, Kings County Medical Complex, and the S.W. Brooklyn Incinerator. Of these the Navy Yard has the most immediate potential for implementation. The Navy Yard has an extensive steam and electrical system that has not been used since the Navy turned most of the property over to New York City more than a decade ago. By remodeling several of the smaller boilers still in place or purchasing new boilers, an ample supply of steam and hot water can be produced. The steam will be used for heating and industrial process for the industrial tenants now occupying the former yards. Hot water will be sold to the New York City Housing Authority to heat between 3,500 and 5,000 nearby public housing units operated by the authority. Electricity will be cogenerated using present generators that will be overhauled. It is expected that some of the electricity will be used directly to supply power to a planned nearby Red Hook Sewage Treatment plant, while most will be sold to the industrial tenants of the Navy Yard. Studies will continue to determine the best market for excess power.

12288 **(PB—83-256008) District heating/cooling assessment for Fort Wayne, Indiana. Final report, 1981-1982.** Hanselman, W.; Jennings, E. (Fort Wayne, City of, IN (USA); Resource Development Associates, Inc., Dayton, OH (USA)). Sep 1982. 178p. NTIS, PC A09/MF A01.

The City of Fort Wayne conducted a feasibility assessment of the potential for a district heating and cooling system to service the southern end of the CBD. A complete inventory of potential heat sources (principally industrial) was made, as well as an inventory of concentrated areas of demand for heat. Fort Wayne conditionally determined that it lacked a truly viable source of thermal energy. There were marginal sources including one refinery but the quality of the heat was low. Trash-fired heat was examined but a good, reliable, and sufficiently large source was not identified.

12289 **(PB—83-256016) Santa Ana Pueblo assessment of district heating and cooling. Final report, 1981-1982.** Jenkins, H.; Giddings, M. (Santa Ana Pueblo, Bernalillo, NM (USA); Western Energy Planners Ltd., Albuquerque, NM (USA)). Jul 1982. 130p. NTIS, PC A07/MF A01.

The Santa Ana Pueblo American Indian Tribe, numbering approximately 600 persons occupies two sites, totalling about 60,000 acres, northwest of Albuquerque, New Mexico. With the aid of consultants it has investigated the community's use of energy and a number of sources of fuel to supply a district heating system. The most promising heat source is the production of methane gas from biomass-utilizing the copious amounts of cattle dung which are readily available from a farm on Tribal grounds. This might be used to: (1) fuel boilers for a district heating system; (2) be piped into individual homes and other users through a dedicated pipeline; or (3) be sold to a local gas company. It might also be compressed in bottles and used as a substitute for gasoline in motor vehicles. There is a supply of geothermal water, its temperature would require enrichment by heat pump or otherwise, and the best locations for wells to tap this resource are uncertain as is also the yield. The heat load requirements of the residential area are not high or concentrated. The cost of retrofitting individual homes to use hot water from a district heating system is estimated at $3,500 each. It was concluded that a much lesser amount of money spent on traditional methods of weatherization would be more cost effective.

12290 **(PB—83-256032) Assessment of district heating/cooling potential in Holland, Michigan. Final report, 1981-1982.** (Holland Board of Public Works, MI (USA); Cummins and Barnard, Inc., Ann Arbor, MI (USA)). Jul 1982. 147p. NTIS, PC A07/MF A01.

Holland has prepared a report describing an analytic assessment of the technical and financial feasibility of modifying the existing municipally owned power plant to supply heat to the community college, a Parke-Davis plant, a Heinz plant, and businesses along the main street of this small Michigan city. The report provides preliminary costs of delivered heat using either steam or hot water and explores the criticality of the heat demand of each major customer and compares their current energy costs with costs of providing heat through the proposed district heating system.

12291 **(PB—83-256040) City of Baltimore, district heating assessment. Final report, 1981-1982.** Lynn, S.; Hanselman, W.; Wade, D. (Baltimore City Dept. of Planning, MD (USA); Resource Development Associates, Inc., Dayton, OH (USA)). Sep 1982. 202p. NTIS, PC A10/MF A01.

The City of Baltimore is utilizing hot water produced from waste fueled boilers cogenerating electricity to supply heat to Cherry Hill a large public housing project, five schools, a nearby hospital and some commercial and industrial users. An eight inch pipe loop will deliver water at a temperature of 250 Fahrenheit from which smaller pipes will connect to heat exchangers in individual building. Most buildings will use hot water for circulation although a few will use converters to produce low temperature steam. The timing is fortuitous, in that the existing heating system is old and is scheduled for renovation. The money will be used for certain retrofit and connection costs rather than to install new boilers. An additional heat load island has been identified known as Hopkins-East Baltimore. This area is an urban renewal area containing seven public housing projects, five public schools, the city jail, John Hopkins hospital and Medical school, private housing and several other institutions. These two areas are good for early start district heating projects, ultimately a still larger system seems feasible.

12292 **(PB—83-256057) Preliminary assessment of district heating and cooling for Atlanta (Georgia). Final report, 1981-1982.** Hanselman, W.; Wade, D. (Atlanta Office of Budget, Audit and Management, GA (USA); Resource Development Associates, Marietta, GA (USA)). Aug 1982. 258p. NTIS, PC A12/MF A01.

The study identified major heat sources from power plants, municipal solid waste, and steel companies developed cost data, and identified and evaluated a number of individual 'early start' projects which could eventually be integrated into an area-wide DHC system. The study then singled out a core area, consisting of three of the potential early starts, for further study. Atlanta's study analyzed the potential economic development benefits of DHC, the environmental impacts of a system, and the institutional and financing issues associated with it. Finally, Atlanta developed an action plan for a detailed feasibility analysis.

12293 **(PB—83-256065) Lawrence, Massachusetts feasibility report, district heating/cooling, phase 1. Final report, 1981-1982.** Clement, K.P. (Lawrence Community Development Dept., MA (USA)). Oct 1982. 171p. NTIS, PC A08/MF A01.

Lawrence is an old mill town. The possibility of using existing industrial boilers to supply energy for a district heating and cooling system was examined. The study was based on Lawrence's Economic Development Energy Plan. The city examined potential consumers and the energy production capabilities of five existing major industrial boilers. The Arlington Mills cogenerating power-

house was the focal point of the study. This plant is being expanded to burn refuse and will include provision for a district heating steam line. The City is also targeting the Arlington neighborhood for residential district heating. Lawrence is unique in its ability to capitalize on a densely developed industrial area and an adjoining residential area. The city is proceeding with detailed financing and engineering studies for an expanded system.

12294 **(PB—83-256081) Bellows Falls district heating assessment, October 1982. Final report, 1981-1982.** Raszmann, D. (Rockingham Planning and Development Office, Bellows Falls, VT (USA)). Oct 1982. 282p. NTIS, PC A13/MF A01.

The town of Rockingham examined a number of energy sources for use in a district heating system in the Village of Bellows Falls. These were: moderate temperature ground water from an aquifer, wood, (a substantial Vermont resource), fuel oil, coal, trash incineration, and electricity. Funds provided under the grant were used to drill nine exploration wells to test the capacity of the aquifer. The Town explored systems alternatives consisting of heat pumps tapping the aquifer, a central boiler system, cogeneration systems, and a municipal waste incineration system. The study examined heat consumption data for the business district of Bellows Falls and the immediately surrounding area. An economic model was developed which calculated the cost of heating provided by each of the alternative systems. The study concluded that a ground water based heat pump system was the preferred option because of its adaptability to phased installation, and lower installed costs. The system selected for further study is a multiple well heat pump system providing water to several buildings. The Town proposes a second phase drilling program to evaluate the potential for intermediate level geothermal activity. It also intends to continue work on a low temperature ground water heat pump system.

12295 **(PB—83-261073) District heating/cooling assessment for the city of Richmond, Indiana. Final report, 1981-82.** Hanselman, W.; Wade, D. (Richmond, City of, IN (USA); Resource Development Associates, Marietta, GA (USA)). Sep 1982. 291p. NTIS, PC A13/MF A01.

The city of Richmond owns and operates the Richmond Power and Light Company-its electric utility. This is a coal fired plant with diesel generators for peaking service. Several heat islands have been identified, the most likely one for an early start of a district heating system consists of two large commercial greenhouses 7-10 acres of glass; these are located about 1,000 feet west of the Richmond State Hospital, which has considerable excess boiler capacity. Both facilities operate on about 150 pounds of steam pressure, and are completely compatible. The path of a connecting steam line is through public land which is nearly level and without any serious obstructions. The hospital boilers are coal fired, the greenhouses use oil. Calculations have established that the coal produced steam costs about 27% of that produced by oil. There is every incentive for both parties to cooperate. Problems still to be solved are emission controls for the coal fired plant, and some legal matters to authorize the state hospital to become a steam supplier for commercial interests. Both are considered to be attainable but require further consideration.

12296 **(PB—83-261081) Berlin, Maryland district heating assessment program: feasibility study. Final report, 1981-1982.** Ahlman, L.; Bireley, R.L. (Berlin, City of, MD (USA); Ebasco Services, Inc., New York (USA)). Sep 1982. 159p. NTIS, PC A08/MF A01.

The Town of Berlin operates its own electric utility system, and is alert to finding ways to reduce local energy costs. For years it has been known that a warm water aquifer exists along a stretch of the Atlantic seaboard from Delaware south into Virginia. At depths of 5,000 to 6,000 feet considerable quantities of water at temperatures of 140 degrees F.-170 degrees F. have been encountered. Oil drilling rigs have run into this at various levels in test holes bored within 5-10 miles of Berlin. The study investigated two aspects: (1) Using drills logs from nearby wells, and geologic data, the probability of obtaining a satisfactory source for Berlin was investigated, and with encouraging results, (2) A survey of potential heat users was conducted to determine whether the cost of installing a hot water distribution system would be economically justified if a producing well is brought in. At these depths a 9 inch producing well doesn't cost much more to drill than smaller test bore. Estimates of cost vary between $350,000 and $800,000.

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REFER ALSO TO CITATION(S) 12221

12297 **(DOE/CS/20256—T1) Connecticut Home Oil Heat Conservation Program. Final performance report.** (Connecticut State Government, Hartford (USA)). [nd]. Contract FG01-79CS20256. 10p. NTIS, PC A02. Order Number DE84005702.

Paper copy only, copy does not permit microfiche production.

A brief summary is presented of the program to increase consumer awareness of conservation devices and to promote oil furnace retrofits through training courses in marketing and servicing and an advertising campaign. Advertising materials are included. (MHR)

12298 **(DOE/CS/20257—T1) New Hampshire Fuel Oil Conservation Marketing Demonstration Program. Phase II, April 23, 1980-December 31, 1981.** (New Hampshire, State of, Concord (USA)). 1981. Contract FG01-79CS20257. 5p. NTIS, PC A02/MF A01. Order Number DE84005474.

The objective of the program was to reduce New Hampshire's residential consumption of No. 2 home heating oil by upgrading heating systems through combustion efficiency testing, tuning, retrofitting and installing energy saving devices. To accomplish this objective, the Energy Office recruited the participation of home heat supply companies and extensively promoted consumer education.

12299 **(DOE/ER/10044—1) Summary of projects funded under Department of Energy Institutional Grant.** Sparrow, F.T. (Purdue Univ., Lafayette, IN (USA). Inst. for Interdisciplinary Engineering Studies). Jan 1984. Contract AC02-79ER10044. 46p. NTIS, PC A03/MF A01. Order Number DE84005067.

This report summarizes the accomplishments which took place at Purdue University as a result of the Department of Energy's Institutional Contract No. DE-AC02-79ER10044.M005 during the period 1979 to 1983. It includes summaries of major research projects, workshops, quick responses, and workshops and symposia funded by the project. The Publications section contains journal articles, presentations, proceedings, and other publications generated from the projects funded by this grant.

12300 **(DOE/NBM—4005844) Community energy planning: the basic elements.** Jones, A.H. (Colorado Office of Energy Conservation, Denver (USA)). 1982. 151p. NTIS, PC A08/MF A01. Order Number DE84005844.

Portions are illegible in microfiche products.

An overview of the energy planning process is provided. A cookbook approach to actually completing an energy plan is presented. Sources for additional information and more detailed data are included. (MHR)

12301 **(DOE/NBM—4005846) Energy you can bank on: energy audit workbook for business.** (Colorado Office of Energy Conservation, CO (USA). Commercial Energy Conservation Program). 1982. 66p. NTIS, PC A04/MF A01. Order Number DE84005846.

The following subjects are covered: energy use, where it goes, comparison with similar users, where energy can be saved, cost of energy conservation, and monitoring the energy management program. (MHR)

12302 **(PB—84-113802) National energy efficient driving system (NEEDS). Volume 2. Driver education program. Final report Sep 77-Dec 81.** McKnight, A.J.; Goldsmith, M.; Shinar, D. (National Public Services Research Inst., Alexandria, VA (USA)). Dec 1981. 105p. NTIS, PC A06/MF A01.

This volume describes a series of studies carried out to determine the most effective approaches to the introduction of fuel-efficient driving through driver education courses. The work described in this volume was part of a broad investigation of voluntary fuel consumption that constituted the National Energy Efficient Driving System (NEEDS) project.

12303 **(PB—84-113810) National energy efficient driving system (NEEDS). Volume 3. Home vehicle use study. Final report Sep 77-Dec 81.** McKnight, A.J.; Goldsmith, M.; Williams, R.D. (National Public Services Research Inst., Alexandria, VA (USA)). 15 Dec 1981. 86p. NTIS, PC A05/MF A01.

This volume describes the nature and results of a Home Vehicle Use Study undertaken to determine the effectiveness of various information feedback systems fostering more efficient use of family vehicles. The study was part of a broad investigation of voluntary fuel consumption that constituted the National Energy Efficient Driving System (NEEDS) project.

12304 **Federal role in energy education in the USA.** Duggan, D.D. (U.S. Dept. of Energy, Washington, DC). pp 719-720 of 5th Miami international conference on alternative energy sources. Vezirogla, T.N. (ed.). Coral Gables, FL; Univ. of Miami (1983). (CONF-821213—).

From 5. international conference on alternative energy source; Miami Beach, FL, USA (13 Dec 1982).

12305 **College/university faculty and student programs at the national laboratories.** Rauckhorst, W.H. (Argonne National Laboratory, IL). pp 726 of 5th Miami international conference on alternative energy sources. Vezirogla, T.N. (ed.). Coral Gables, FL; Univ. of Miami (1983). (CONF-821213—).

From 5. international conference on alternative energy source; Miami Beach, FL, USA (13 Dec 1982).

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS

REFER ALSO TO CITATION(S) 12251

3301 Internal Combustion Engines

REFER ALSO TO CITATION(S) 11709, 12331, 12338, 12341, 12343

12306 (CONF-821055—, pp 145-154) **Advanced gas turbine technology development (systems and components).** Rackley, R.A.; Kreiner, D.M. (Garrett Turbine Engine Co., Phoenix, AZ). Apr 1983. NTIS, PC A16/MF A01.

From 20. automotive technology development contractors' coordination meeting; Dearborn, MI, USA (25 Oct 1982).

The Garrett/Ford AGT101 Program has progressed through initial design, fabrication, first generation aerodynamic component tests, and currently is focused on engine test bed development and ceramic component development. Many significant development activities have been accomplished, including successful full-speed operation of the AGT101 Mod I (1600°F) engine to 100,000 rpm. A complete set of ceramic static structures, consisting of 49 parts, was assembled and successfully tested in the structures rig to the Mod I (1600°F) design conditions. Many ceramic structures have passed thermal screening tests to 2100°F. A silicon nitride rotor, produced cooperatively by ACC and Ford, has been spin tested at room temperature to 102,000 rpm, which exceeds the maximum power design condition. Aerothermodynamic component testing of the first iteration AGT101 (2500°F) turbine design has been completed. Results of these tests show that final program goals have been exceeded in the low-power regime and initial goals have been exceeded at maximum power. The second compressor test has been completed with results showing that design flow and pressure ratio goals have been achieved. Combustion fuel nozzle development indicates that program emission goals are achievable within the program time frame.

12307 (CONF-821055—, pp 155-166) **Advanced gas turbine technology development: AGT 100 systems and components.** Helms, H.E.; Johnson, R.A. Apr 1983. NTIS, PC A16/MF A01.

From 20. automotive technology development contractors' coordination meeting; Dearborn, MI, USA (25 Oct 1982).

The advanced technologies to make the gas turbine a viable alternative to the spark ignition and diesel engines of the future are being developed. Goals have been established for fuel economy, emissions, and production cost that could allow the gas turbine to be competitive with these engines in the 1990 time frame. High-risk new technology elements are ceramic engine components and high-efficiency small airflow aerodynamic components. Current effort includes building the first AGT 100 engine, component qualification testing, and improvements to ceramic component strengths. The first engine with nine ceramic parts started shakedown testing in July. All major components and systems have passed qualification testing. Prototype silicon carbide rotors have been spin tested to 110,000 rpm (127% design speed), and new ceramic tooling is producing parts with higher strengths than those tested. Silicon nitride parts are also being developed.

12308 (CONF-821055—, pp 167-178) **Ceramic applications in turbine engines (CATE).** Thrasher, S.R. (Detroit Diesel Allison, MI). Apr 1983. NTIS, PC A16/MF A01.

From 20. automotive technology development contractors' coordination meeting; Dearborn, MI, USA (25 Oct 1982).

The objective of the Ceramic Applications in Turbine Engines (CATE) program is to apply ceramic components in a highway vehicle gas turbine engine and reduce fuel consumption by improving engine cycle efficiency due to operation at higher temperatures. The Allison GT 404-4 is the test engine for this program. As originally planned, ceramics were to be applied incrementally at successively higher operating temperatures, beginning with 1900°F, increasing to 2070°F and, finally, to 2265°F. Evaluation of the initial ceramic components at 1900°F has been successfully completed. The 2070°F configuration has been concurrently designed, initial ceramic component process development and fabrication have been completed, and an advanced process development experiment is nearing completion. Rig and engine testing of the 2070°F-configuration ceramic components have been conducted. Detroit Diesel Allison (DDA), Division of General Motors Corporation, has successfully engine tested the ceramic gasifier turbine nozzle and rotor assembly and the ceramic regenerator system to the maximum 2070°F-configuration operating conditions.

12309 (CONF-821055—, pp 181-188) **Development of ceramic components for gas turbine engines.** Groseclose, L.E.; Heitman, P.W.; Chang, J. Apr 1983. NTIS, PC A16/MF A01.

From 20. automotive technology development contractors' coordination meeting; Dearborn, MI, USA (25 Oct 1982).

Ceramic component activity under CATE and AGT 100 programs has focused on the development of material strength characteristics in fullscale hardware. Emphasis has been directed toward net-shape processing of silicon carbide components (most notably blades and rotors). Selected components have also been produced from a variety of silicon-based and zirconia materials. State-of-the-art processing and strength characteristics have been realized in the 2070°F-configuration CATE turbine blades. To further improve these properties, a development study is currently being conducted with Carborundum (CBO). In addition, processing methodology for structurally sound AGT 100 gasifier rotors has been established. Fullscale rotors can now be produced with cold-spin capability consistently greater than 100% design speed. Additional studies are currently in progress. Extensive development activities focusing on applicable fixturing and joining technology required for the complex AGT 100 gasifier scroll assembly are also proceeding.

12310 (CONF-821055—, pp 189-197) **Advanced gas turbine ceramic component development.** Boyd, G.L.; Carruthers, D.W.; Kidwell, J.R.; Richerson, D.W. (Garrett Turbine Engine Co., Phoenix, AZ). Apr 1983. NTIS, PC A16/MF A01.

From 20. automotive technology development contractors' coordination meeting; Dearborn, MI, USA (25 Oct 1982).

The Garrett/Ford AGT101 Program has progressed through initial design, fabrication, and first generation aerodynamic component tests, and currently is focused on engine test bed development and ceramic component development. Design A ceramic components of excellent visual quality have been received from the AiResearch Casting Company, Carborundum Company, Corning, Ford, and NGK. These components are being qualified for engine testing through a sequence of evaluations that include bulk density, NDE, dimensional inspection, visual examination up to 40x magnification, selected mechanical and thermal screening tests, and static structure rig tests. Individual static structure ceramic components have been qualified up to 2100°F in thermal screening test. The complete ceramic static structure, consisting of 49 components, has successfully been tested under cyclic conditions in the static structure test rig to the Mod I design conditions of 1600°F. A bladed rotor, fabricated cooperatively by AiResearch Casting Company and Ford Motor Company, has been spin tested at room temperature to 102,000 rpm.

12311 (CONF-821055—, pp 199-204) **Ceramic technology progress report: DOE/AMMRC ceramic materials program.** Katz, R.N.; Lenoe, E.M. Apr 1983. NTIS, PC A16/MF A01.

From 20. automotive technology development contractors' coordination meeting; Dearborn, MI, USA (25 Oct 1982).

Plans and preliminary progress on tasks relating to life prediction, time-temperature dependence of advanced ceramics, and toughened ceramics are presented.

12312 (CONF-821055—, pp 211-226) **Highlights in the development of the KTT automotive gas turbine.** Kronogard, S.O. (United Turbine, Malmo, Sweden). Apr 1983. NTIS, PC A16/MF A01.

From 20. automotive technology development contractors' coordination meeting; Dearborn, MI, USA (25 Oct 1982).

To provide some background and orientation, the main features of the KTT (Kronogard Turbine Transmission) System are reviewed and illustrated. Then a few comments are included about component and subsystems development before the Mark I engine and vehicle testing are summarized. The outlook for the Mark II engine is assessed.

12313 (CONF-821055—, pp 229-230) **DOE/NASA heavy-duty transport technology program.** Davison, H.W. (Lewis Research Center, Cleveland, OH). Apr 1983. NTIS, PC A16/MF A01.

From 20. automotive technology development contractors' coordination meeting; Dearborn, MI, USA (25 Oct 1982).

This new program is intended to provide a technology base for industry to use in developing heavy-duty transport engines. The program focuses on advanced diesel engine technology, waste heat utilization, materials, and tribology. Applications notices were sent to industry to encourgae their ideas and participation. An excellent response was received as indicated by the receipt of over 80 proposals addressing various research activities applicable to heavy-duty transport. The program organization, current activities, and funding expectations are presented.

12314 (CONF-821055—, pp 231-241) **Cummins advanced turbocompound diesel engine evaluation.** Hoehne, J.L.; Werner, J.R. (Cummins Engine Co., Inc., Columbus, IN). Apr 1983. NTIS, PC A16/MF A01.

From 20. automotive technology development contractors' coordination meeting; Dearborn, MI, USA (25 Oct 1982).

The turbocompound diesel engine has been under development at Cummins Engine Company since 1972. Development reached a mature stage following the evolution of three power turbine and gear train designs. In 1978, the Department of Energy sponsored a program for comprehensive vehicle testing of the turbo-compound engine. Upon successful completion of the vehicle test program, an advanced turbocompound diesel engine program was initiated in 1980 to improve the tank mileage of the turbocompound engine by 5% over the vehicle test engines. Engine improvements could be realized by increasing the available energy of the exhaust gas at the turbine inlet, incorporating gas turbine techniques into improving the turbomachinery efficiencies, and through refined engine system optimization. This paper presents the individual and cumulative performance gains achieved with the advanced turbocompound engine improvements.

12315 (CONF-821055—, pp 243-259) **Status report on diesel organic Rankine compound engine for long - haul trucks.** Koplow, M.D.; DiNanno, L.R.; DiBella, F.A. Apr 1983. NTIS, PC A16/MF A01.

From 20. automotive technology development contractors' coordination meeting; Dearborn, MI, USA (25 Oct 1982).

Among the efforts in this year's Truck Bottoming Cycle Program was the installation and testing of an organic fluid throttle valve located at the outlet of the vapor generator. The second Test Bed Vehicle (TBV No. 2) equipped with this mechanism and advanced bottoming cycle hardware was operated over the Mack fuel economy course and resulted in a 13.2-percent fuel savings in the 1100-mile test. This fuel savings is a major accomplishment towards the program goal - a 15-percent reduction in fuel consumption. Component development has continued with testing of the vapor generator and evaluation of a soot-blowing scheme for maintaining long-term vapor generator heat transfer effectiveness. Further development of the microprocessor-based control system has emphasized the optimization of the Bottoming Cycle System performance. Other work included stability testing of Fluorinol-85 in a specially constructed fluid loop. Baseline tests at a fluid temperature of 550°F have shown no decomposition in 1600 hours of operation.

12316 (CONF-821055—, pp 261-272) **Light Duty Vehicle Diesel Engine Assessment program passenger car diesel engine of the future.** Kamo, R.; Tozzi, L.; Sekar, R. (Cummins Engine Co., Columbus, IN). Apr 1983. NTIS, PC A16/MF A01.

From 20. automotive technology development contractors' coordination meeting; Dearborn, MI, USA (25 Oct 1982).

The objectives of the Light Duty Vehicle Diesel Engine Assessment program and the work tasks required to accomplish the same are outlined. The power plant and vehicle requirements for the future automobile are presented. The important related economic and technical parameters are ranked. The potentially promising engine concepts and advanced technologies available to meet those requirements are identified and discussed. Conceptual evaluation has disclosed a moderate speed, four stroke, high BMEP diesel engine which is compounded by a positive displacement screw expander and compressor. The power plant will be adiabatic with no cooling water and of minimum friction design with no oil for lubrication. Reliance on advanced materials and technologies is stressed.

12317 (CONF-821055—, pp 273-290) **TACOM/Cummins adiabatic Engine Program.** Bryzik, W. Apr 1983. NTIS, PC A16/MF A01.

From 20. automotive technology development contractors' coordination meeting; Dearborn, MI, USA (25 Oct 1982).

The goals, progress, and future plans of the TACOM/Cummins Adiabatic Engine Program are discussed. The Adiabatic Engine concept insulates the diesel combustion chamber with high temperature materials to allow hot operation near an adiabatic operation condition. Additional power and improved efficiency derived from this concept occur because thermal energy, normally lost to the cooling and exhaust systems, is converted to useful power through the use of turbomachinery and high-temperature materials. Engine testing has repeatedly demonstrated the Adiabatic Engine to be the most fuel efficient engine in the world with multicylinder engine performance levels of 0.285 LB/BHP-HR (48% thermal efficiency) at 450 HP representative. Installation of an early version of the Adiabatic Engine within a military 5 ton truck has been completed, with initial vehicle evaluation successfully accomplished. Design and procurement of long lead time items for the next generation of Adiabatic Engine in the 600 to 750 HP power range is continuing. Work on the minimum-friction Adiabatic Engine version continues.

12318 (CONF-821055—, pp 325-331) **Effective values of evaporation constant for hydrocarbon fuel drops.** Chin, J.S.; Lefebvre, A.H. Apr 1983. NTIS, PC A16/MF A01.

From 20. automotive technology development contractors' coordination meeting; Dearborn, MI, USA (25 Oct 1982).

Experimental values of evaporation constant for use in calculations of evaporation rates and drop lifetimes are fairly sparse and are usually confined to conditions of steady-state evaporation in quiescent mixtures at normal atmospheric pressure. The main objective of the present study is to provide effective values of evaporation constant that cover wide ranges of ambient air pressure, temperature and velocity, and which also take into account the influence of the heat-up period in lowering the overall evaporation rate. The average boiling point (50 percent recovered) is the physical property selected to characterize the volatility of the fuel.

12319 **(DOE/ET/15303—T7) HC quench layer formation in combustion processes. Final report.** Lavoie, G.A.; Adamczyk, A.A. (Ford Motor Co., Dearborn, MI (USA)). Dec 1983. Contract AC04-79ET15303. 129p. NTIS, PC A07/MF A01. Order Number DE84005068.

Portions are illegible in microfiche products. Original copy available until stock is exhausted.

Processes believed responsible for unburned hydrocarbon (HC) emissions in spark-ignition engines have been investigated in a joint study carried out by Ford and the University of Michigan (U-M). Two closely related experiments were performed at Ford and U-M together with an analytical study carried out at U-M. In the experimental work, combustion bombs fitted with identical turbulence generating inlet swirl systems were used to study the effect of turbulence on unburned HC emissions from wall quench and crevices. In the analytical work, a model was developed describing the turbulent wall quench layer in an engine. It also includes the cylinder wall oil-film and ring crevices as additional sources of hydrocarbons which feed into the wall layer after combustion. The results of the studies show that wall quench is not a major source of HC emissions in the bomb and that the effect of increased turbulence on the low emissions from wall quench is to reduce them further. Emissions from crevices introduced into the bomb were found to be more important than those from wall quenching. Turbulence did not greatly affect the HC emissions from the crevices. In the flow studies the gas motion generated by the inlet system on the bombs was found to approximate a solid body rotation with a decay time of 200 msec. High speed schlieren photography was used to observe the flame propagation and the filling and emptying of the crevices. The analytical model compared favorably with experimental engine data and supported the view that oil films and crevices are major sources of hydrocarbons in engine combustion.

12320 **(DOE/NASA/0168—6) Advanced Gas Turbine (AGT) technology project. Sixth semiannual report, July 1-December 31, 1982.** (General Motors Corp., Indianapolis, IN (USA). Allison Gas Turbine Operations). May 1983. Contract AI01-77CS51040. 47p. (NASA-CR—168325). NTIS, PC A02/MF A01. Order Number DE84005661.

The engine structure, bearings, oil system, and electronic control have been successfully demonstrated, with no shaft dynamics or other vibration problems encountered. Areas identified during the five tests, which require modification, are the scroll retention features, and transient thermal deflection of turbine backplates. Modifications have been analyzed and designed and are in the fabrication process; testing with these new turbine components will begin early in calendar year 1983. Scroll retention is being addressed by modifying the seal arrangement in front of the gasifier turbine assembly, which will increase the pressure load on the scroll in the forward direction and thereby increase the retention forces. The backplate thermal deflection is being addressed by geometric changes and thermal insulation to reduce heat input. Combustor rig proof testing of two ceramic combustor assemblies has been completed. Except for the combustor domes, two sets of ceramic components (combustor body, pilot tube, and dilution bands) have been qualified for engine testing. The combustor dome design has been modified to incorporate slots and reduce sharp edges, which should reduce thermal stresses. The evaluation of regenerator system flow distribution revealed significant potential losses in regenerator effectiveness due to maldistribution of flow. Design modifications have regained almost all of the lost effectiveness with only a small increase in pressure drop, making the regenerator drive system ready for incorporation into the engine. The initial electronic control system hardware has been bench tested, has interfaced successfully with test stand systems, and has been instrumental in successfully controlling and protecting the engine during the engine testing.

12321 **(DOE/NASA/51040—51) Bending fatigue of electron-beam-welded foils. Application to a hydrodynamic air bearing in the Chrysler/DOE upgraded automotive gas turbine engine.** Saltsman, J.F.; Halford, G.R. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Jan 1984. Contract AI01-77CS51040. 27p. (NASA-TM—83539). NTIS, PC A03/MF A01. Order Number DE84005871.

A hydrodynamic air bearing with a compliant surface is used in the gas generator of the Chrysler/DOE upgraded automotive gas turbine engine. In the prototype design, the compliant surface is a thin foil spot welded at one end to the bearing cartridge. During operation, the foil failed along the line of spot welds which acted as a series of stress concentrators. Because of its higher degree of geometric uniformity, electron beam welding of the foil was selected as an alternative to spot welding. Room temperature bending fatigue tests were conducted to determine the fatigue resistance of the electron beam welded foils. Equations were determined relating cycles to crack initiation and cycles to failure to nominal total strain range. A scaling procedure is presented for estimating the reduction in cyclic life when the foil is at its normal operating temperature of 260°C (500°F).

12322 **Ignition delay and heat release analysis of an ethanol fumigated turbocharged diesel engine.** Gao, X.; Borman, G.; Foster, D.; Ye, Z. (Department of Mechanical Engineering, University of Wisconsin-Madison, Madison, WI 53706). *American Society of Mechanical Engineers, [Paper]*; 83-DGP-1: 9(1983). Contract AC02-79CS50025.

A turbocharged, open chamber diesel engine was fumigated with prevaporized ethanol and run over its speed and load range. The mass percentage of ethanol was varied from zero to 80% at light load and zero to 50% at full load. Digitized cylinder pressure data were cycle averaged and used to examine ignition delay and to calculate heat release patterns and NO production. It is shown that the ignition delay is increased by the thermodynamic effects of fumigation, but it can be decreased by chemical effects of alcohol reactions if the cylinder gas temperature is above approximately 900 K (1600°R). The heat release model uses three zones; a diesel fuel-ethanol zone, an air-ethanol zone and a products zone. The mode predicts that fumigation causes a large increase in the initial burning spike even when the fumigation decreases the ignition delay. Fumigation decreases combustion duration slightly at heavy load but greatly increases the duration at light loads. Values of NO concentration computed from the product zone properties and Zeldovich kinetics predict the observed exhaust NO trends, but are about twice too high in value.

3302 External Combustion Engines

REFER ALSO TO CITATION(S) 11759

12323 (CONF-821055—, pp 3-5) **Overview of the US Department of Energy's Automotive Stirling Engine Technology Development Program.** Sutton, P.L. (Dept. of Energy, Washington, DC). Apr 1983. NTIS, PC A16/MF A01.

From 20. automotive technology development contractors' coordination meeting; Dearborn, MI, USA (25 Oct 1982).

Presented from the point of view of the US Department of Energy's Program Office, the overview is a synopsis of the Automotive Stirling Engine Technology Development Program's accomplishments of the 1981-82 program year and the program's current status. The MOD I Stirling engine is the focal point of the program. Four MOD I engines have been and continue to be tested and evaluated. Areas of study include: power and efficiency; materials and component development, including use of ceramics; engine downsizing and packaging; hydrogen containment; durability/reliability; multifuel capability; and others. Upcoming program-sponsored projects are briefly described.

12324 (CONF-821055—, pp 33-51) **Stirling engine applications study.** Teagan, W.P.; Cunningham, D.R. Apr 1983. NTIS, PC A16/MF A01.

From 20. automotive technology development contractors' coordination meeting; Dearborn, MI, USA (25 Oct 1982).

Potential applications for Stirling engines are surveyed in the power range from 0.5 to 5000 hp. Applications are grouped into a small number of classes (10), with the applications in each class having a high degree of commonality in performance and cost requirements. A review of conventional engines was then undertaken to determine the nature of the competition faced by a new engine system. In each application class the Stirling engine was compared to conventional engine systems, assuming that objectives of ongoing Stirling engine development programs are met. This ranking process indicated that Stirling engines showed potential for use in all application classes except very light duty applications (lawn mowers, etc.). However, this potential is contingent on demonstrating much greater operating life and reliability than has been demonstrated to date by developmental Stirling engine systems.

12325 (CONF-821055—, pp 53-62) **Automotive Stirling Engine Development Program overview and status report.** Nightingale, N.P. Apr 1983. NTIS, PC A16/MF A01.

From 20. automotive technology development contractors' coordination meeting; Dearborn, MI, USA (25 Oct 1982).

The Automotive Stirling Engine (ASE) Development Program has been under contract from DOE/NASA since March 1978. Four Mod I engines have accumulated more than 1338 total test hours. One of these engines was installed in a transient test bed (TTB) where its transient characteristics were evaluated. This accomplishment marked the completion of a major program milestone, established at the program's inception and scheduled for completion by September 30, 1982. The ASE program has continued to meet its contractual requirements despite the uncertainty surrounding Government appropriations. Major design changes were made in the Reference Engine System Design (RESD) to reduce manufacturing cost. Advances were achieved in the areas of combustion, low-cost material, seals, drive system, regenerator, and control system development. A design effort to upgrade the Mod I is proceeding on schedule for system test in April 1983.

12326 (CONF-821055—, pp 63-68) **Automotive Stirling Engine Development Program Mod I Stirling engine system performance.** Richey, A. Apr 1983. NTIS, PC A16/MF A01.

From 20. automotive technology development contractors' coordination meeting; Dearborn, MI, USA (25 Oct 1982).

The initial characterization of the first Mod I engine was completed in August 1981. Since that time, development efforts have added significant steady-state data to the design base, as well as accomplished initial engine transient evaluation through fuel economy testing. Relative to earlier P-40 Stirling engine-powered vehicles within the ASE program, fuel economy improvements of up to 50% have been achieved with the Mod I engine. An advanced version of this engine, the Mod I-A, is currently in the design stage; analytical projections indicate substantial improvements in engine specific weight and fuel economy. Mod I Stirling Engine System Development during the past year has concentrated on the building and testing of two additional engines, and the continued testing of the initial Mod I engine. Improvements identified during the early stages of the Mod I testing are being pursued in the Mod I development program, as well as in the design of an advanced Mod I engine, the Mod I-A. Testing of the Mod I engine has established performance levels during steady-state operation and has documented auxiliary power consumption. Base-line transient test bed assessments have demonstrated significant improvements in fuel economy relative to previous Stirling-powered vehicles. The results of these test programs are presented and performance improvements achievable in the Mod I-A engine are projected.

12327 (CONF-821055—, pp 69-85) **Upgraded Mod I Stirling engine design (Mod I-A).** Moodysson, B.O. Apr 1983. NTIS, PC A16/MF A01.

From 20. automotive technology development contractors' coordination meeting; Dearborn, MI, USA (25 Oct 1982).

A first generation engine, called Mod I has been developed within the program and has been under test since the beginning of 1981. To date four engines have been built and tested for over 1300 hours. These engines now serve as baseline experimental engines in the program. The upgrading of Mod I will prove technologies embodied in the Reference Engine System Design (RESD). The paper highlights design improvements in the first phase of this Proof-of-Concept. Main objectives for the present design, called Mod I-A, have been: improved power and power density (specific weight) and improved fuel economy, Mod I-A goals are shown relative to Mod I data. In addition the design has focused on: reduced manufacturing cost; void of strategic materials; and better packageability (reduced size). Mod I-A is due to be tested in April 1983, and to demonstrate also improved durability and reliability and transient capability.

12328 (CONF-821055—, pp 87-92) **Automotive Stirling Engine Development Program Mod I Stirling engine emissions with exhaust gas recirculation.** Farrell, R.A. Apr 1983. NTIS, PC A16/MF A01.

From 20. automotive technology development contractors' coordination meeting; Dearborn, MI, USA (25 Oct 1982).

Steady-state emissions testing of three Mod I Stirling engines burning unleaded gasoline was performed with exhaust gas recirculation (EGR) at United Stirling of Sweden (USAB) and Mechanical Technology Incorporated (MTI). Both constant and variable EGR were evaluated for their impact on gaseous emissions. EGR was found to have an exponential effect on NO/sub x/, but none on CO and HC if $\lambda > 1.2$. The testing, in addition to demonstrating good engine-to-engine repeatability, showed that Automotive Stirling Engine (ASE) Development Program requirements for NO/sub x/, CO and HC can be met with EGR.

12329 (CONF-821055—, pp 93-101) **Automotive Stirling Engine Development Program Stirling engine alternative fuels test results.** Battista, R.A. Apr 1983. NTIS, PC A16/MF A01.

From 20. automotive technology development contractors' coordination meeting; Dearborn, MI, USA (25 Oct 1982).

Emissions measurements were made on a 40-kW (54-hp) Stirling engine burning five liquid fuels - unleaded gasoline, shale-derived marine diesel, gasohol (ET-3), ERBS, and commercial diesel. Emissions were measured with and without exhaust gas recirculation (ERG), and the results showed little difference in the levels of NO/sub x/, CO, and HC emissions for all the fuels tested, particularly with EGR. The results of the test and correlations of the emissions data with external heat system (EHS) parameters are reviewed. The effects of the fuel type on the performance of the EHS are also discussed.

12330 (CONF-821055—, pp 103-113) **Stirling engine materials research at NASA Lewis, MTI, and USAB.** Stephens, J.R. (Lewis Research Center, Cleveland, OH); Cronin, M.T.; Skog, E. Apr 1983. NTIS, PC A16/MF A01.

From 20. automotive technology development contractors' coordination meeting; Dearborn, MI, USA (25 Oct 1982).

A coordinated materials research program for the automotive Stirling engine is under way at NASA Lewis Research Center, Mechanical Technology Incorporated, and United Stirling Sweden. The programs at the three organizations have emphasized the high-temperature materials associated with the heater head. NASA Lewis has focused on creep-rupture properties, hydrogen permeation and embrittlement, oxidation resistance, and simulated engine condition effects on heater-head tubes. MTI has been responsible for fatigue evaluation and failure analysis. USAB has been evaluating materials in engine operation and creep-rupture tests of internally pressurized heater-head tube alloys. An update of research conducted at the three organizations over the past year is provided.

12331 (CONF-821055—, pp 115-130) **Free-piston Stirling hydraulic drive for automobiles.** Beremand, D.G.; Slaby, J.G.; Miao, D. (Lewis Research Center, Cleveland, OH). Apr 1983. NTIS, PC A16/MF A01.

From 20. automotive technology development contractors' coordination meeting; Dearborn, MI, USA (25 Oct 1982).

This analytical study compares the calculated fuel economy of an automotive free-piston Stirling hydraulic engine and drive system with a pneumatic accumulator to the fuel economy of both a conventional 1980 spark-ignition engine in an X-body class vehicle and the estimated fuel economy of a 1984 spark-ignition engine. The results of the study show that the free-piston mission hydraulic system with a two-speed transmission has a combined fuel economy nearly twice that of the 1980 spark-ignition engine - 21.5 to 10.9 km/liter (50.7 to 25.6 mpg) under comparable conditions. The fuel economy improvement over the 1984 spark-ignition engine is 81 percent. The overall engine and drive system efficiency (ratio of power to wheels to fuel in) is 36 percent. The study also includes the fuel economy sensitivity of the Stirling hydraulic system to system weight, number of transmission shifts, reduced drag coefficient, and varying vehicle performance requirements.

12332 (CONF-821055—, pp 131-141) **Look at a cooled, insulated Stirling engine.** Tomazic, W.A. (Lewis Research Center, Cleveland, OH). Apr 1983. NTIS, PC A16/MF A01.

From 20. automotive technology development contractors' coordination meeting; Dearborn, MI, USA (25 Oct 1982).

A simple analysis was made on a new Stirling engine design concept. The concept makes use of an insulating ceramic liner in a cooled metal structure to form cylinders and regenerator housings. The concept is intended to reduce greatly the need for expensive, strategic, high-temperature alloys and to improve efficiency. The analysis reported herein revealed that significant efficiency improvement is possible if cylinder inner-wall temperatures can be increased and made more uniform along the cylinder length. Potential efficiency gains as high as 20 percent for a 40-kW, 1000-rpm engine were calculated. The results of this analysis, which did not address potential practical problems related to the use of ceramic liners, suggest that this concept deserves a rigorous thermal and design analysis to define its potential benefits and limitations.

3303 Electric-powered Systems

REFER ALSO TO CITATION(S) 12101

12333 **(AD-A—132549/7) Baseline and verification tests of the Electric Vehicle Associates' Current Fare Station Wagon. Final test report, 27 March 1980-6 November 1981.** Dowgiallo, E.J. Jr; Chapman, R.D. (Army Mobility Equipment Research and Development Center, Fort Belvoir, VA (USA)). Jan 1983. 113p. NTIS, PC A06/MF A01.

The EVA Current Fare Station Wagon, an electric vehicle, was tested at MERADCOM as part of a Department of Energy project to characterize the state-of-the-art of electric vehicles. The current Fare Wagon was manufactured in Cleveland, Ohio by Electric Vehicle Associates' Incorporated. It is powered by 22 6-V lead-acid batteries driving a 30-hp d.c. series motor through an SCR controller. The motor drives the rear wheels through a manually operated 4-speed transmission. Regenerative braking was provided.

12334 **(CONF-821055—) Proceedings of the twentieth automotive technology development contractors' coordination meeting.** (USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC. Office of Vehicle and Engine Research and Development). Apr 1983. 366p. NTIS, PC A16/MF A01. Order Number DE83016840.

From 20. automotive technology development contractors' coordination meeting; Dearborn, MI, USA (25 Oct 1982).

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Thirty-four papers are included. Two were previously abstracted for EDB. Separate abstracts were prepared for thirty-two papers. (MHR)

12335 **Electric vehicle test and evaluation data: preliminary analysis.** Friedman, K.; Magro, W. (U.S. Department of Energy, Washington, DC). *Energy Technology (Washington, D.C.);* **10**: 771-783(Jun 1983). (CONF-830213—).

From 10. energy technology conference; Washington, DC, USA (28 Feb 1983).

The data in this paper summarizes the current experience of DOE private sector site operators and is based on information gathered from electric vehicle (EV) private sector site operators by Booz, Allen and Hamilton under contract to the U.S. Department of Energy. Since January 1980, Booz, Allen has collected and computerized on an IBM Personnel computer data from 16 private sector site operators covering nine vehicle types and over 1.3 million miles of vehicle travel. The paper summarizes key indicators of vehicle performance including energy consumption per mile and miles travelled per charge and reports on results of and plans for special analyses. More detailed information is available from the authors.

3306 Vehicle Design Factors

REFER ALSO TO CITATION(S) 12256

12336 **(PB—84-115021) Investigation of the applicability of a stored hydraulic energy propulsion system to a conventional bus. Final report Aug 80-Aug 83.** (Tri-County Metropolitan Transportation District of Oregon, Portland (USA)). Sep 1983. 134p. NTIS, PC A07/MF A01.

The objective of this investigation was to determine the feasibility of using stored energy hydraulic propulsion (SHEP) technology in current transit buses, and to present an evaluation of the fuel savings and economic cost/benefits of the SHEP systems that are currently in the concept and hardware stages of development for transit coaches. The analysis included a determination of the current status of SHEP systems proposed or developed anywhere in the world. The costs and benefits resulting from the operation of the proposed systems were analyzed from actual and computer projected data using a transit coach computer simulation model. This report includes a description of the computer simulation model and an extensive list of references pertinent to the report subject, as well as numerous charts depicting transmission systems, drive systems, and other hydraulic stored energy projection systems.

3308 Alternative Fuels

REFER ALSO TO CITATION(S) 11685, 12322

12337 (CONF-821055—, pp 307-315) **Utilization of alternative fuels in a diesel engine.** Lestz, S.S.; Geyer, S.M.; Jacobus, M.J. Apr 1983. NTIS, PC A16/MF A01.

From 20. automotive technology development contractors' coordination meeting; Dearborn, MI, USA (25 Oct 1982).

A 1978 Oldsmobile 5.7 l V-8 Diesel engine was operated on DF-2 and DF-M (shale oil), and a single-cylinder 0.3 l Avco-Bernard engine was operated on DF-2 and various vegetable oils. The objective of the V-8 study was to screen the DF-M fuel prior to beginning a more detailed single-cylinder engine study. The objective of the vegetable oil tests was to provide a detailed comparison of these oils and DF-2. In both cases, performance and emission data were obtained and biological activity of the soluble organic fraction of particulate samples was determined using the Ames Test. Results of the V-8 study show about equal performance and Ames Test activity for both fuels. With the vegetable oil tests, a slight increase in thermal efficiency was noted, but this was accompanied by slight increases in gas phase emissions and large increases in total aldehyde and particulate mass emissions. The Ames activity of the vegetable oils appears to be lower than that of the DF-2.

12338 (CONF-821055—, pp 317-323) **Ability for conventional IC engines to run on fuels derived from coal and oil shale.** Needham, J.R.; Norris-Jones, S.R.; Cooper, B.M. Apr 1983. NTIS, PC A16/MF A01.

From 20. automotive technology development contractors' coordination meeting; Dearborn, MI, USA (25 Oct 1982).

The interaction between IC engines and fuels was studied. Both indirect and direct injection diesel and spark ignited stratified charge combustion systems were addressed. Fuels covered regular D-2 diesel, low ignition quality diesel fuel, naphtha and naphtha/diesel fuel broadcuts. Candidate combustion systems for future fuel groups are examined and the necessity for further research in specified areas highlighted for a full understanding.

12339 (CONF-821055—, pp 333-346) **Identification and evaluation of optimized alternative fuels.** Sefer, N.R.; Russell, J.A.; Ryan, T.W. III; Callahan, T.J. (Southwest Research Inst., San Antonio, TX). Apr 1983. NTIS, PC A16/MF A01.

From 20. automotive technology development contractors' coordination meeting; Dearborn, MI, USA (25 Oct 1982).

Alternative highway transportation fuels were studied in three project phases. First, refining studies used linear programming models of composite regional refineries. Shale oils and coal liquids were included with petroleum crudes to make forecast 1995 product slates. Product variations included maximum diesel fuel and broadcut fuel in three regions. Methanol, ethanol, and MTBE in gasoline blends were explored in one region. In the second phase, fuels were formulated based on the refining studies, and blends were prepared using synthetic components. Products were shared with other laboratories for their evaluation. The third phase was engine testing of diesel fuels, broadcut fuels, and gasolines. Screening tests in single-cylinder CLR engines were applied to all fuels. Selected fuels were given durability tests in the same engines. Other fuels were tested in city and highway cycles in vehicles on a chassis dynamometer. The project identified potential fuel problems and promising fuel-engine combinations.

12340 (CONF-821055—, pp 349-358) **Summary: report of hydrogen SI engine research.** Adt, R.R. Jr.; Swain, M.R.; Pappas, J.M. Apr 1983. NTIS, PC A16/MF A01.

From 20. automotive technology development contractors' coordination meeting; Dearborn, MI, USA (25 Oct 1982).

The objective of the project is to document an experimental design data-base on hydrogen-fueled automotive engines. The effort is directed toward possible future designs of airbreathing piston engines using hydrogen. To this end, pertinent performance and emissions (NO/sub x/ only) characteristics of 19 engine configurations are presented. Configurational variations of a 1600 cc automotive test engine included: throttled and unthrottled operation (i.e., quantity and quality power level control); central manifold, port, direct cylinder injection; single and divided combustion chambers; exhaust gas recirculation (EGR), water induction and air injection; and certain other features. Comparisons of these hydrogen-engine characteristics with the stock gasoline-fueled reference case are made at the same displacements, and at a (stock) compression ratio of 9.0:1.

12341 (CONF-821055—, pp 367-376) **Research investigation of alcohol usage in spark ignition engines.** Browning, L.H.; Nebolon, J.F.; Pefley, R.K. (Univ. of Santa Clara, CA). Apr 1983. NTIS, PC A16/MF A01.

From 20. automotive technology development contractors' coordination meeting; Dearborn, MI, USA (25 Oct 1982).

Research investigations of alcohol fuels for automobile engines continues to show alcohols as viable alternative fuels to gasoline. However, some technical problems still need continued research before alcohol fuels enter the public sector. These problems are cold starting, increased engine wear, increased aldehyde emissions and the unknown impact of these fuels on the environment. Research at the University of Santa Clara has continued to center on these problems and a description of this research is presented here.

12342 (CONF-821055—, pp 377-382) **Evaluation of fuel additives to reduce engine and fuel system material problems with methanol-gasoline blends.** Rodriguez, C.F.; Cuellar, J.P. Jr. Apr 1983. NTIS, PC A16/MF A01.

From 20. automotive technology development contractors' coordination meeting; Dearborn, MI, USA (25 Oct 1982).

Commercial fuels were screened for inhibition of material incompatibilities with methanol-gasoline blends. The additives, chosen to provide a diversity of applications and chemical types, were tested at four methanol concentration levels. Corrosivity tests were conducted on metals commonly used in automotive applications. Polymeric materials - elastomers, plastics and cork - were tested for compatibility with the methanol blends. As a result of these tests half of the additives were subjected to further testing in search of optimal application conditions. The completed screening phase indicated three additives which inhibit corrosive effects of the blends on some metals; no effects were noted on the polymeric materials. Optimization continues with a reduced number of additives, materials, and methanol blends.

12343 (DOE/BC/10495—7) **Testing of an electronically-controlled fuel injection system (EFIS) for alternative fuels in diesel engines. Final report, June 15, 1981-December 31, 1982.** Utvik, D.H.; Spadaccini, L.J.; Jaminet, J.F.; Titus, R.R. (United Technologies Research Center, East Hartford, CT (USA)). Apr 1983. Contract AC19-81BC10495. 144p. NTIS, PC A07/MF A01. Order Number DE84006063.

A program was conducted to investigate the feasibility of operating a medium-speed stationary diesel engine on coal-derived liquid fuels. The overall objective of the program was to formulate control system algorithms for three middle-distillate alternative fuels, namely SRC-II, Exxon Donor Solvent (EDS) and H-Coal, for an optimum utilization of these fuels as diesel fuel extenders without adversely affecting engine performance and operation. A Mack six-cylinder, direct-injection, turbocharged engine was used to simulate a medium-speed stationary diesel powerplant. The program comprised a number of experimental and analytical tasks including injector spray characterization tests, diesel engine tests and development of engine control algorithms. Engine testing was accomplished under several tasks including baseline tests with No. 2 diesel fuel as well as fuel mapping tests, on-line fuel blending tests and fumigation tests with alternative fuel blends. With regard to fueling strategies for the coal-derived fuels, on-line blending investigations demonstrated the feasibility of operating a diesel engine with alternative fuel blends over a wide range of conditions. In particular, it was found that the Mack engine could be operated satisfactorily on highly loaded blends of EDS, H-Coal and SRC-II alternative fuels over a range of speed conditions from 800 to 1500 rpm as well as over a range of part-load conditions, although with reduced fuel economy at low loads. Finally, using the data bank generated from the program, algorithms were developed for describing engine performance and control over a range of operating conditions for EDS, H-Coal and SRC-II fuels blended with No. 2 diesel fuel. These algorithms demonstrate the methodology required in the prototype development of an electronically-controlled injection system for diesel engines capable of multifuel operation, and constitute a preliminary first step in that development. 10 references, 79 figures, 3 tables.

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12344 (RFP—3529) **Component development annual report, June 1981-June 1982.** Brown, W.G. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 8 Nov 1983. Contract AC04-76DP03533. 32p. NTIS, PC A03/MF A01. Order Number DE84005829.

Reported are: bakeout studies for nickel-plated HP-9-4-20 high-strength steel, surface cleaning and handling of OFHC copper, cleaning and compatibility of nonnuclear weapon components with various process materials, impression materials and cleaning systems, method for removing machining residues from interior confined passages, corrosion-resistance study of paint coatings on uranium alloys, corrosion tests of zinc coatings on a U-0.75 Ti, ignition studies on coated and uncoated uranium alloys, stainless steel fitting failures on nitric acid lines, analysis of drybox glove failures at Rocky Flats, environmental testing of inventory bar-code labels, evaluation of a styrene butadiene foam gasket as a filter/vent for the 55-gallon drum waste container, development of a carbon-bonded fiber venting system for radioactive waste containers, development of a corrugated steel container for shipment and storage of TRU waste, evaluation of acid-resistant HEPA filter media, characteristics of TRU waste at DOE sites, evaluation of Viton glovebox window gaskets, evaluation of flash-fire protective clothing, evaluation of polymeric materials for glovebox machining operations, and investigation of the hydrogen peroxide system in Building 371.

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REFER ALSO TO CITATION(S) 11436, 11592, 11616, 11621, 11628, 11628, 11630, 11671, 11675, 11970, 12330

12345 **(AD-A—131223/0) Mechanism of anaerobic (microbial) corrosion. Technical summary report No. 1, 1 Jun-31 Dec 82.** Iverson, W.P.; Olson, G.J. (National Measurement Lab. (NBS), Washington, DC (USA)). Dec 1982. 40p. NTIS, PC A03/MF A01.

This report in the form of three papers describes research into the role of bacteria in anaerobic corrosion processes. During the year we have given more evidence for a novel mechanism of anaerobic corrosion in which a volatile, highly reactive phosporous compound is produced as a result of the activities of sulfate-reducing bacteria (Desulfovibio desuluricans). The corrosion product is an amorphous type of iron phosphide which can be detected by the formation of phosphine upon its acidification. Phosphine (in addition to H2S) has been detected from all the cases of suspected anaerobic corrosion (including tubercles from the inside of water pipes) examined so far. In examining the headspace over growing cultures of Desulfovibio to detect this volatile phosphorus containing compound, using a gas chromatograph (GC) with a flame photometric detector (FPD) specific for phosphorus and sulfur, two sulfur compounds, in addition to H2S, were detected and identified. These compounds, methylmercaptan, and dimethyldisulfide, were found to be relatively non-corrosive to iron under anaerobic conditions. No volatile phosphorus compounds were detected.

12346 **(AD-A—131961/5) Anisotropy and microstructure of Sm2(Co,Fe,Cu,Zr)17 magnetic materials. Final report, January 1982-January 1983.** Fidler, J.; Grossinger, R.; Kirchmayr, H.; Skalicky, P. (Technische Univ., Vienna (Austria). Inst. fuer Angewandte und Technische Physik). May 1983. 135p. NTIS, PC A07/MF A01.

The present report is divided into two parts, the anisotropy measurements and the microstructural investigations of Sm2(Co,Fe,Cu,Zr)17 magnetic materials. Section I shows that the pulsed field technique is a versatile extension of a static magnetometer. Beside the possibility of generating fields up to 280 k theta e it can be used an an instrument with specific possibilities. An example for this is the SPD-technique which delivers even for polycrystalline samples - a value for the anisotropy field Ha. Up to now no clear correlation between the magnetic parameters like coercivity or energy product and the absolute value of Ha is possible. However, the knowledge of Ha allows the application of models which may help to understand the occurrence of these parameters. The temperature dependence of Ha should be mainly determined by the temperature dependence of the magnetization of the Sm sublattice. If this is known the validity of the One Ion Model can be tested. The role of the partly substituted Co sublattice is not so clear. More accurate M(T) measurements should be done. The influence of the inter-atomic distance on Ha(T), which should exist according to to an extended One Ion model, necessitates the knowledge of the thermal expansion.

12347 **(ANL—83-93) Intergranular crack propagation rates in sensitized Type 304 stainless steel in an oxygenated water environment.** Park, J.Y.; Shack, W.J. (Argonne National Lab., IL (USA)). 1 Dec 1983. Contract W-31-109-ENG-38. 34p. NTIS, PC A03/MF A01. Order Number DE84005311.

Intergranular stress-corrosion crack (IGSCC) propagation rates were measured in three heats of sensitized Type 304 stainless steel (SS) as a function of applied load and sensitization in high-purity water with 8 ppM. Active-loading tests yielded IGSCC propagation rates ranging from $\sim 2 \times 10^{-10}$ to 1×10^{-9} m/s ($\sim 2 \times 10^{-5}$ to 2×10^{-4} in./h) over the range of stress intensities from 25 to 46 MPa$\sqrt{m}$ (22 to 41 ksi$\sqrt{in}$.). If the dependence of propagation rate on stress intensity is assumed to follow a power law, a least-squares fit of data yields $(da/dt) = 1.23 \times 10^{-9} K^{2.42}$ (in./h) for K in ksi$\sqrt{in}$. Deflection-controlled tests on standard 12.7-mm-thick compact tension specimens yielded IGSCC propagation rates from 7×10^{-12} to 2×10^{-10} m/s (10^{-6} to 2×10^{-5} in./h) at effective average stress intensities in the range 21 to 26 MPa$\sqrt{m}$ (19 to 24 ksi$\sqrt{in}$.). Crack lengths were determined by compilance measurements using in-situ high-temperature clip gage or LVDT methods, optical metallography on the side faces of the specimen, and fractography of the cracked surface after completion of the tests. The optical metallography measurements did not provide useful estimates of crack lengths, because large variations in IGSCC propagation across the thickness of the specimens occurred. The effects of the degree of sensitization on the IGSCC propagation rate are obscured by the data scatter. However, it seems clear that these variables do not lead to order-of-magnitude changes in the crack propagation rate.

12348 **(CONF-8310129—2) Austenitizing and microstructure of a HT-9 steel.** Wilcox, R.C.; Chin, B.A. (Auburn Univ., AL (USA). Dept. of Mechanical Engineering). 1983. Contract AS05-82NE37900. 22p. NTIS, PC A02/MF A01. Order Number DE84004914.

From American Society for Metals conference on copper and copper alloys; Philadelphia, PA, USA (3 Oct 1983).

The effects of austenitizing temperatures and times on the microstructure of a 12Cr-1Mo-V-W steel are reported. Austenitizing temperatures covering the range of 900 to 1225°C and times of 30 minutes to 100 hours were used. Equilibrium microstructures were difficult to obtain because delta ferrite initially present in the steel resists dissolution during austenitizing. 10 figures.

12349 **(CONF-8310205—4) TEM studies on the deformation structure of Cu-10Ni-6Sn spinodal alloy.** Shekhar, S.; Lee, T.C.; Subramanian, K.N. (Michigan State Univ., East Lansing (USA). Dept. of Metallurgy, Mechanics and Material Science). 1983. Contract AC02-81ER10942. 20p. NTIS, PC A02/MF A01. Order Number DE84004426.

From TMS-AIME fall meeting; Philadelphia, PA, USA (2 Oct 1983).

Deformation structure of deformed bulk specimens, aged for various lengths of time, was investigated by transmission electron microscopy, so as to understand the mechanism of hardening in spinodally-modulated alloys. Burgers vector analysis of dislocations, that appeared to have emanated from sources active during deformation, indicated that edge and screw disolcations were mostly responsible for the deformation in homogenized specimens. On the other hand, mixed dislocations, with their Burgers vector oriented at 60° to the dislocation line, seemed to be responsible for deformation and hardening in specimens with modulated structure.

12350 **(DOE/ER/05002—38) Study of the structure of grain boundaries in metals.** Balluffi, R.W. (Massachusetts Inst. of Tech., Cambridge (USA)). Jan 1984. Contract AC02-78ER05002. 16p. NTIS, PC A02/MF A01. Order Number DE84005493.

A brief review is given of a number of topics associated with the study of grain boundary structure in metals. These include the various frameworks which have been used to describe structure, a commentary on the major research methods which have been employed and, finally, some of the more important aspects of the current status of the field. 46 references.

12351 **(DOE/NBM—4005684) Preparation and evaluation of submerged-arc weld in 4 inch thick 3Cr-1.5Mo-0.1V steel plate. Final report.** Wada, T.; Cox, T.B. (AMAX Metals Group, Ann Arbor, MI (USA). Research Lab.). 15 Dec 1983. Contract W-7405-ENG-26. 25p. NTIS, PC A02/MF A01. Order Number DE84005684.

A 79-pass submerged-arc weld joint was prepared in a 4-inch thick 3Cr-1.5Mo-0.1V steel plate using welding wire with a composition similar to the base plate. Welding was made without difficulty, and no cracking was observed after stress relieving at 1175 F (635 C) for 4 hours. After stress relieving to tensile strength levels of 80 to 110 ksi (550 to 760 Mpa), tensile and Charpy impact properties of the weld metal and the heat-affected zone (HAZ) were determined. The HAZ exhibited virtually the same tensile strength and toughness as the base plate. The weld metal exhibited somewhat lower toughness, while its tensile strength was equivalent to that of the base plate.

12352 **(DP-MS—83-21) Thermodynamic model of natural, medieval and nuclear waste glass durability.** Jantzen, C.M.; Plodinec, M.J. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1983. Contract AC09-76SR00001. 40p. (CONF-8308149—2). NTIS, PC A03/MF A01. Order Number DE84005195.

From Conference on glass in planetary and geological phenomena; Alfred, NY, USA (14 Aug 1983).

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A thermodynamic model of glass durability based on hydration of structural units has been applied to natural glass, medieval window glasses, and glasses containing nuclear waste. The relative durability predicted from the calculated thermodynamics correlates directly with the experimentally observed release of structural silicon in the leaching solution in short-term laboratory tests. By choosing natural glasses and ancient glasses whose long-term performance is known, and which bracket the durability of waste glasses, the long-term stability of nuclear waste glasses can be interpolated among these materials. The current Savannah River defense waste glass formulation is as durable as natural basalt from the Hanford Reservation (10^6 years old). The thermodynamic hydration energy is shown to be related to the bond energetics of the glass. 69 references, 2 figures, 1 table.

12353 **(DP-MS—83-61) Stability of radioactive waste glasses assessed from hydration thermodynamics.** Plodinec, M.J.; Jantzen, C.M.; Wicks, G.G. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1983. Contract AC09-76SR00001. 10p. (CONF-831174—62). NTIS, PC A02/MF A01. Order Number DE84005192.

From Materials Research Society annual meeting; Boston, MA, USA (14 Nov 1983).

Assessment of the geologic performance of radioactive waste glasses requires extrapolation of finite tests to very long times. Hydration thermodynamics provides a means to compare the stability of waste glasses to natural analogues and to ancient synthetic glasses. The glass composition is separated into structural components of known free energy of hydration. These are then summed to provide a discrete measure of the stability of a given glass to aqueous attack. Hydration thermodynamics can be used to extend the results of laboratory tests of Savannah River waste glass to the repository environment. 15 references, 3 figures, 1 table.

12354 **(EGG-M—16983) Comparison of predicted versus experimentally-determined stresses for crack initiation of surface flaws in a 304 stainless steel and a ferritic steel.** Reuter, W.G.; Place, T.A. (EG and G Idaho, Inc., Idaho Falls (USA); Idaho Univ., Moscow (USA)). Nov 1983. Contract AC07-76ID01570. 12p. (CONF-8311130—2). NTIS, PC A02/MF A01. Order Number DE84005481.

From International conference on fracture prevention in energy and transport systems; Rio de Janeiro, Brazil (27 Nov 1983).

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This paper presents a comparison between K/sub Ic/ and an empirical approach for predicting stresses for crack initiation under conditions varying from elastic to plastic. The comparisons are based on tests conducted on specimens containing surface flaws. No correlation existed between K/sub Ic/ and empirically-determined parameters. However, conditions for crack initiation can be predicted if a few tests are conducted on specimens containing surface flaws to develop empirical correlations.

12355 **(HEDL—7412) Swelling in simple ferritic alloys irradiated to high fluence contribution to ADIP report.** Gelles, D.S.; Meinecke, R.L. (Hanford Engineering Development Lab., Richland, WA (USA)). 1983. Contract AC06-76FF02170. 7p. NTIS, PC A02/MF A01. Order Number DE84004389.

A series of Fe-Cr-C-Mo simple alloys has been measured for density change as a function of irradiation in EBR-II over the temperature range 400 to 650°C to fluences as high as 2.13×10^{23} n/cm² (E > 0.1 MeV) or 105 dpa. The highest swelling was found in an Fe-12Cr binary alloy, 4.72%, after 1.87×10^{23} n/cm² or 95 dpa at 425°C, which corresponds to a swelling rate of 0.06% dpa. This peak swelling rate value can be used to define swelling predictions for commercial ferritic alloys to 40 MWy/m².

12356 **(LBL—16530) Welding superalloy sheet for superconducting cable jackets.** Summers, L.T.; Strum, M.J.; Morris, J.W. Jr. (Lawrence Berkeley Lab., CA (USA)). Aug 1983. Contract AC03-76SF00098. 8p. (CONF-830841—29). NTIS, PC A02/MF A01. Order Number DE84005183.

From Cryogenic engineering conference and international cryogenic materials conference; Colorado Springs, CO, USA (15 Aug 1983).

Autogenous gas tungsten arc welds produced in A-286 exhibit significantly lower yield and ultimate tensile strengths than comparably heat-treated base metal. Deformation in the aged weld metal is highly localized and delineates the dendritic microstructure. The observed mechanical properties are caused by the formation of precipitate-free regions located at the dendrite cores. These regions form as the result of titanium segregation during weld pool solidification which yields dendrite cores sufficiently lean in titanium as to prevent nucleation of the hardening phase.

12357 **(LBL—16613) Physical metallurgy and alloy design of dual phase steels.** Thomas, G. (Lawrence Berkeley Lab., CA (USA)). Aug 1983. Contract AC03-76SF00098. 48p. NTIS, PC A03/MF A01. Order Number DE84005182.

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From the standpoint of their superior properties, and simplicity in composition and processing, dual-phase steels show great promise, not only for the transportation industry, but for general structural applications, e.g., pipelines, wires, rods and bars. Their advantages include economy of material and enormous flexibility wherein a single alloy can be manipulated to provide a wide range of products and properties. The main limitations of low carbon dual phase steels for general applications are material dimensions, i.e., sufficient hardenability must be achieved (~ 0.5 in. thickness/diameter) to obtain martensite/bainite on quenching from the ($\alpha + \gamma$) field, and problems of microstructure control if welding must be done after the dual phase treatment. 26 figures.

12358 **(LBL—16972) Effects of high magnetic fields on the microstructure and toughness of cryogenic ^{9}Ni steel.** Fior, G.O.; Fultz, B.; Morris, J.W. Jr. (Lawrence Berkeley Lab., CA (USA)). Jun 1983. Contract AC03-76SF00098. 8p. (CONF-830659—22). NTIS, PC A02/MF A01. Order Number DE84005198.

From TMS/AIME topical conference on ferritic alloys for use in nuclear energy technologies; Snowbird, UT, USA (19 Jun 1983).

Commercial 9Ni cryogenic steel was heat-treated to develop thermally unstable retained austenite. Some of this austenite was transformed to martensite by exposing the material to: (1) cryogenic temperatures, and (2) cryogenic temperatures plus 17 T magnetic fields. Those specimens exposed to the high magnetic fields consistently had the lower Charpy toughness. X-ray crystallography showed that the magnetic exposure caused additional $\gamma \rightarrow \alpha'$ transformation. Scanning electron fractography indicated that this additional $\gamma \rightarrow \alpha'$ transformation resulted in additional quasi-cleavage fracture, and therefore a lower toughness. It is shown that the equilibrium thermodynamics of the coexistence of magnetic phases in magnetic fields cannot account for the large increases in the amount of $\gamma \rightarrow \alpha'$ transformation caused by the magnetic field. We therefore propose that our $\gamma \rightarrow \alpha'$ transformation is a process with an activation barrier that may be overcome by magnetic exposure. The effect of the $\gamma \rightarrow \alpha'$ transformation on the Charpy energy was mostly temperature-independent, however. This suggests that the mechanism of fracture associated with the $\gamma \rightarrow \alpha'$ transformation is not thermally activated.

12359 **(LBL—17014) Effect of Rhodamine-B on the electrodeposition of lead on copper.** Farmer, J.C.; Muller, R.H. (Lawrence Berkeley Lab., CA (USA)). Dec 1983. Contract AC03-76SF00098. 46p. (CONF-830508—28). NTIS, PC A03/MF A01. Order Number DE84005535.

From 163. Electrochemical Society meeting; San Francisco, CA, USA (8 May 1983).

Rhodamine-B chloride (10 μM) has been used as a model substance of plating additives in a study of the electrodeposition of Pb from 1 M $NaClO_4$, 0.5 and 5 mM Pb^{++} (pH 3) on Cu. Ellipsometer measurements during cyclic voltammetry have shown that

the addition of dye results in a more compact bulk deposit than obtained in its absence. It also prevents complete monolayer coverage during formation of the Pb underpotential deposit and shifts the bulk deposition peak to more cathodic potentials during the first potential cycle. Dye effects on potential and micromorphology disappear during subsequent cycling, but reappear after relaxation periods at open circuit. Depletion and readsorption of dye on the surface have been confirmed by spectroscopic ellipsometry. Different optical film models have been investigated for the interpretation of spectroscopic ellipsometer measurements by use of multidimensional analysis.

12360 **(PB—83-247676) Fractographic study of cracks produced by thermal shocks in 20MnMoNi55 and comparable weld material in water environment.** Toerroenen, K.; Kemppainen, M.; Rintamaa, R. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). [nd]. 31p. NTIS, PC E04/MF E01.

This report gives the results of a fractographic study of cracks produced by thermal shocks in 20MnMoNi55 and comparable weld material in water enviroment. The basic crack growth mechanism is shown to be by mechanical fatigue, but after some crack growth indications of environmentally assisted cyclic crack growth is seen. (Copyright (c) Valtion teknillinen tutkimuskeskus (VTT) 1983.)

12361 **(PNL-SA—11125) Application of zircaloy deformation and fracture maps to predicting dry spent fuel storage conditions.** Chin, G.A.; Madsen, N.H.; Khan, M.A. (Auburn Univ., AL (USA)). Aug 1983. Contract AC06-76RL01830. 38p. (CONF-830897—5). NTIS, PC A03/MF A01. Order Number DE84005607.

From NRC workshop on spent fuel/cladding reactions during dry storage; Gaithersburg, MD, USA (17 Sep 1983).

The research reported details the development of theoretical deformation and fracture maps for Zircaloy at temperatures between 50 and 850°C and for stresses between 5 and 500 MPa. The maps predict behavior which is in agreement with a large number of experimental observations reported in the literature. Transformations in deformation and fracture mechanisms, creep rate magnitudes, and times to fracture are predicted from the maps. Results are reported for grain sizes of 5 μm. The deformation and fracture maps are altered for irradiation effects based upon high stress-high temperature, short time, postirradiation data. Maximum allowable temperature limits to achieve 40 years dry storage are calculated as a function of time spent in wet pool storage using a decaying cask temperature function and a life fraction rule. 122 references, 15 figures, 4 tables.

12362 **(PNL-SA—11404) Wire tensile testing for radiation hardening experiments.** Bradley, E.R.; Jones, R.H. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1983. Contract AC06-76RL01830. 28p. (CONF-8309170—6). NTIS, PC A03/MF A01. Order Number DE84005884.

From Symposium on the use of nonstandard subsized specimens for irradiated testing; Albuquerque, NM, USA (23 Sep 1983).

Nickel, niobium, vanadium, and titanium wire specimens were irradiated with T(d,n) neutrons, Be(d,n) neutrons, or 16-MeV protons to fluence levels ranging from 0.2 to 30 x 10^{21} m^{-2}. The tensile data indicated that yield strength measurements can provide a reliable method to evaluate the hardening produced by high-energy particle irradiations. The precision of the yield strength data ranged from 0.03 to 0.18 depending on radial flux gradients, material grain size, and wire diameter. Greater variations were observed in the elongation and strain-hardening data; these variations were attributed to the tapered gage sections produced by electropolishing. Tensile elongation and work hardening were also strongly dependent on specimen diameter.

12363 **(SAND—83-8239) Biaxial tension tests of HERF 304L stainless steel.** Hughes, D.A. (Sandia National Labs., Livermore, CA (USA)). Jan 1984. Contract AC04-76DP00789. 24p. NTIS, PC A02/MF A01. Order Number DE84006205.

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High strength (100 ksi) High Energy-release Rate Forged (HERF) 304L stainless steel is being considered for future weapon components. The potential yield anisotropy of this HERF 304L stainless steel was investigated via biaxial loading experiments. Biaxial tensile tests with proportional loading were performed on thin-walled tubular specimens using internal pressure and axial load. Results of these tests revealed significant yield strength anisotropy in the forgings. As a consequence, traditional isotropic yield criteria, such as the von Mises or Tresca theories, were not representative of the forged strengths. Yield strengths in a biaxial stress state with a stress ratio $\sigma/\text{sub}\ \theta//\sigma/\text{sub}\ z/ = 2$ were 20% less than that calculated by the von Mises criteria and the axial yield strength. A stress ratio of $\sigma/\text{sub}\ \theta//\sigma/\text{sub}\ z/ = 2$ is similar to the anticipated service-induced stress state for the forged component.

12364 **(UCID—19970) Aluminum and polymeric coatings for protection of uranium.** Colmenares, C.; McCreary, T.; Monaco, S.; Walkup, C.; Gleeson, G.; Kervin, J.; Smith, R.L.; McCaffrey, C. (Lawrence Livermore National Lab., CA (USA)). 21 Dec 1983. Contract W-7405-ENG-48. 28p. NTIS, PC A03/MF A01. Order Number DE84006261.

Ion-plated aluminum films on uranium will not provide adequate protection for 25 years. Magnetron-plated aluminum films on uranium are much better than ion-plated ones. Kel-F 800 films on uranium can provide adequate protection for 25 years. Their use in production must be delayed until the following factors are sorted out: water permeability in Kel-F 800 must be determined between 30 and 60°C; the effect of UF_3, at the Kel-F/metal interface, on the permeability of water must be assessed; and the effect of crystallinity on water permeability must be evaluated. Applying Kel-F films on aluminum ion-plated uranium provides a good interim solution for long term storage.

12365 **(UCID—19983) Dynamic compressive strain rate tests on two types of beryllium.** Breithaupt, D. (Lawrence Livermore National Lab., CA (USA)). 8 Dec 1983. Contract W-7405-ENG-48. 11p. NTIS, PC A02/MF A01. Order Number DE84006126.

High strain rate (10^3 sec^{-1}) compression tests were conducted on 1162A and 1319A beryllium using the split Hopkinson bar technique. Stress strain and strain rate data were obtained on 1162A beryllium to 25% strain. 5 figures.

12366 **First wall and limiter surfaces for plasma devices.** Krauss, A.R.; Gruen, D.M. (to Dept. of Energy). US Patent 4,414,176. 8 Nov 1983. Filed date 1 Jun 1981. vp.

PAT-APPL-269235.

For a plasma device, a surface of a first wall or limiter with reduced loss of metal by erosion is provided by forming a monolayer of an alkali or alkaline earth metal on a substrate of a more negative metal. The surface exhibits a reduced loss of metal by erosion and particularly by sputtering and an increased secondary ion/neutral ratio resulting in a greater return of atoms escaping from the surface. In another aspect of the invention, the substrate includes a portion of the second metal and serves to replenish the surface layer with atoms of the second metal. In one process associated with selfgenerating desired surface, the metals as an alloy are selected to provide a first layer having a high concentration of the second metal in contrast to a very low concentration in the second layer and bulk to result in a surface with a monolayer of the second metal. When the combination of metals results in an intermetallic compound, selective removal of the first metal during an initial bombardment stage provides the surface layer with a predominance of the second metal.

12367 **Magnetooscillations in dislocation drag processes.** Goldman, P.D.; Galligan, J.M.; Motowidlo, L.K. (Department of Metallurgy and Institute of Materials Science, University of Connecticut, Storrs, Connecticut 06268). *Scripta Metallurgica;* **17**: No. 6, 755-756(Jun 1983).

This paper reports on measurable changes in stress in the case of cadmium crystals. These measurements demonstrate that the observed oscillatory changes in stress are solely related to the motion of dislocations. The measurements explicitly rule out a change in stress which is related to magnetothermal oscillations, magnetostrictive effects, as well as any thermal effects. The magnetothermal oscillations are ruled out on a number of grounds, includ-

ing the fact that magnetothermal oscillations are only observable under strictly adiabatic conditions, the magnitude of magnetothermal oscillations are 2 to 3 orders of magnitude smaller than the observed change in stress. The thermal effects are ruled out by the fact that there is no observed temperature change in the chamber whether the magnetic field is changed rapidly or very slowly.

12368 **Correlation of acoustic and electrochemical noise in the stress-corrosion cracking of α-brass.** Newman, R.C.; Sieradzki, K. (Corrosion Science Group, Building 703, Brookhaven National Laboratory, Upton, New York 11973). *Scripta Metallurgica;* 17: No. 5, 621-624(May 1983). Contract AC02-76CH00016.

This paper presents the first results of an investigation which aims to demonstrate the discontinuous nature of transgranular stress-corrosion cracking (TGSCC) in brass and to account for it in terms of the dynamics of competing plastic deformation and brittle crack growth. By selecting a suitable combination of electrolyte and electrochemical potential, the sudden increments of crack growth are made visible in the form of anodic current transients. These are then correlated with acoustic emission. Calculation of the charge density passed between successive current transients shows that the depth of the chemical attack in this period is less than 40 nm.

12369 **The effect of hydrogen solubility on the internal friction of V-Ti alloys.** Owen, C.V.; Buck, O. (Ames Laboratory - US DOE, Iowa State University, Ames, IA 50010). *Scripta Metallurgica;* 17: No. 5, 649-650(May 1983). Contract W-7405-ENG-82.

The purpose of this note is to present results of low frequency internal friction measurements on three hydrogenated V-Ti alloys which illustrate how the internal friction spectrum changes from one dominated by hydride precipitation to one dominated by hydrogen in solution. Demonstrates how damping due to hydrogen changes in b.c.c. alloys as the hydrogen terminal solid solubility increases. Low solubility alloys exhibit a broad damping peak at temperatures that can be associated with hydride precipitation. As the hydrogen solubility increases, peaks due to hydride precipitation and hydrogen in solid solution can co-exist in the alloy, or as in the case for the V-10 at .% Ti alloy containing 2.3 at .% H, only the low temperature hydrogen damping will occur.

12370 **Chemically driven cavity growth.** Shewmon, P.G.; Lopez, H.; Parthasarathy, T.A. (Department of Metallurgical Engineering, The Ohio State University, Columbus, Ohio 43210). *Scripta Metallurgica;* 17: No. 1, 39-43(Jan 1983).

This article deals exclusively with methane bubbles in ferritic steel, since this is the system most studied. The fine scale of the bubbles and the large volume of material homogeneously attacked makes it a useful model system for comparision with systems undergoing creep. Cavity growth kinetic models, and their relation to those derived for creep cavities, are treated first since much more work has been done on growth than on nucleation. Growth kinetics is a means of making inferences about nucleation. Chemically driven cavity growth (CDCG) enables the observation of the development of cavities more directly than in creep.

12371 **Introduction to the viewpoint set on creep cavitation.** Nix, W.D. (Department of Materials Science and Engineering, Stanford University, Standford, California 94305). *Scripta Metallurgica;* 17: No. 1, 1-4(Jan 1983).

This paper examines the various mechanisms involved in creep cavitation caused by the nucleation, growth and coalescence of intergranular cavities. These cavities form microcracks which propagate through the material to cause failure. A brief review is given of the physical processes involved in creep cavitation. The presented viewpoints have been brought together to report on progress in this field and to stimulate further thought and research on these topics.

12372 **Al_2S_3 preparation and use in electrolysis process for aluminum production.** Hsu, C.C.; Loutfy, R.O.; Yao, N.P. US Patent Application 6-364,281. [nd]. 14p. Contract W-31-109-ENG-38.

A continuous process for producing aluminum sulfide and for electrolyzing the aluminum sulfide to form metallic aluminum in which the aluminum sulfide is produced from aluminum oxide and COS or CS_2 in the presence of a chloride melt which also serves as the electrolysis bath. Circulation between the reactor and electrolysis cell is carried out to maintain the desired concentration of aluminum sulfide in the bath.

12373 **Method for decontamination of nickel-fluoride-coated nickel containing actinide-metal fluorides.** Windt, N.F.; Williams, J.L. US Patent Application 6-453,983. [nd]. 14p. Contract W-7405-ENG-26.

In one aspect, the invention comprises contacting nickel-fluoride-coated nickel with gaseous ammonia at a temperature effecting nickel-catalyzed dissociation thereof and effecting hydrogen-reduction of the nickel fluoride. The resulting nickel is heated to form a melt and a slag and to effect transfer of actinide metals from the melt into the slag. The melt and slag are then separated. In another aspect, nickel contianing nickel oxide and actinide metals is contacted with ammonia at a temperature effecting nickel-catalyzed dissociation to effect conversion of the nickel oxide to the metal. The resulting nickel is then melted and separated as described. In another aspect nickel-fluoride-coated nickel containing actinide-metal fluorides is contacted with both steam and ammonia. The resulting nickel then is melted and separated as described. The invention is characterized by higher nickel recovery, efficient use of ammonia, a substantial decrease in slag formation and fuming, and a valuable increase in the service life of the furnace liners used for melting.

12374 **Heat treatment of NiCrFe alloy 600 to optimize resistance to intergranular stress corrosion.** Steeves, A.F.; Bibb, A.E. US Patent Application 6-447,727. [nd]. 20p. Contract AC12-76SN00052.

A process of producing a NiCrFe alloy having a high resistance to stress corrosion cracking comprises heating a NiCrFe alloy to a temperature sufficient to enable the carbon present in the alloy body in the form of carbide deposits to enter into solution, rapidly cooling the alloy body, and heating the cooled body to a temperature between 1100 to 1500°F for about 1 to 30 hours.

12375 **Chemical synthesis of thin films and supported crystals by oxidation of zintl anions.** Haushalter, R.C. US Patent Application 6-455,614. [nd]. 13p. Contract W-31-109-ENG-38.

Processes are described for (1) depositing main group metals on inorganic and metallic substrates, (2) depositing transition metals on organic, inorganic and metallic substrates, and (3) depositing combinations of main group metals and transition metals on organic, inorganic and metallic substrates. The resulting products have useful electrical, optical and/or decorative properties.

3602 Ceramics, Cermets, And Refractories

REFER ALSO TO CITATION(S) 11436, 11560, 11969, 12207, 12965

12376 **(AD-A—132698/2) Low-frequency Raman scattering from vitreous and molten B2O3. Technical report.** Walrafen, G.E.; Hokmabadi, M.S.; Krishnan, P.N.; Guha, S.; Munro, R.G. (Howard Univ., Washington, DC (USA). Dept. of Chemistry). 8 Sep 1983. 47p. (TR—15). NTIS, PC A03/MF A01.

Integrated Raman intensities of bands between 0-900 per cm have been obtained for molten B203 from 288-906 C. Emphasis was placed on the highly depolarized low-frequency contour (adjoining the exciting line) which is intense, broad, skewed to high frequencies, and displays a weak, broad, shoulder centered between 100-150 per cm. The total integrated contour intensity from 0-300 as well as the peak intensity, obey the one-phonon Bose-Einstein (B.-E.) relation within 6%. The integrated intensity of the polarized 800 per cm boroxol ring (B306) line, however, decreases with temperature rise, in quantitative agreement with previous work, J. Chem. Phys., 72, 113 (1980), and correction using neutron scattering results yields a enthalpy H value of 5.0 kcal/mole ring rupture.

The low-frequency contour probably involves nonsymmetric collective modes of very large assemblies, cages, or rings, as well as librations of B306 groups (100-150 per cm), and the fact that the B.-E. distribution is obeyed at temperatures for which B306 ring rupture is important indicates that such large temporal aggregates are involved that whether B03 triangles or B306 rings are present may be nearly irrelevant.

12377 (CEA-CONF—6654) **Methods for product qualification and quality assurance.** Brie, M.; Guery, M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Apr 1983. 17p. (CONF-8304124—2). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704345.

From Specialist meeting on absorbing pins and materials; San Francisco, CA, USA (11 Apr 1983).

The improved analytical procedures for stoichiometric determination of boron carbide are described. From a large number of measurements made on boron carbide of various origins, the stoichiometric ratio appears related to the production process. The magnesium reaction process yields a product with stoichiometry Bsub(3.63)C representing the limit of the carbon-rich boron carbide phase. On the other hand, the melting process yields a solid solution Bsub(4.45)C, which shows a congruent melting point at 2450°C. Formulation B_4C or $B_{13}C_8$ is not a limit. Among the quality assurance tests, a non-destructive method based on gamma absorptiometry has been developed in order to check the uniformity of boron carbide pellet density. Accurate pseudo-density curves are obtained owing to the self-calibration method in which the mass absorption coefficient is measured for each individual pellet. Through determination of the non-uniformity index this method permits quantitative assessment of production quality and repeatability. Gamma absorptiometry is also useful to determine the point density of boron carbide pellet prior to irradiation in order to obtain an accurate point swelling measurement.

12378 (CEA-R—5237) **Fundamental study of industrial boron carbide.** Zuppiroli, L.; Kormann, R.; Lesueur, D. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). Sep 1983. 75p. (In French). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84750476.

Some of the physical properties of boron carbide, before and after irradiation are reviewed on the basis of several new experiments performed in our laboratory. The layered aspect of the grains of this ceramic, due to a microtwinning of the rhombohedral structure, is emphasized first. Then, the location of free carbon in samples of composition close to B_4C is discussed in relation with new sputtering experiments. Coupled studies of the electric conductivities and the electron spin resonance lines have demonstrated the important role of free carbon in the electronic properties of boron carbide and revealed the existence of a homogeneous short range disorder, the origin of which is not very clear (amorphous concept). The elementary processes responsible of the swelling and microcracking of neutron irradiated boron carbide are rather well understood. The role of the point defects in these processes is reported. The displacement threshold energies and formation volumes are discussed in relation with electron irradiation experiments, and displacement rates are calculated in different irradiation situations including neutron irradiations.

12379 (CONF-821055—, pp 205-210) **Sintered Si_3N_4 for high performance thermomechanical applications.** Pasco, W.D.; Greskovich, C.D. (General Electric Co., Schenectady, NY). Apr 1983. NTIS, PC A16/MF A01.

From 20. automotive technology development contractors' coordination meeting; Dearborn, MI, USA (25 Oct 1982).

The gas pressure sintering (GPS) process for dense (>99%) Si_3N_4 containing ~ 7% $BeSiN_2$ and ~ 3.5 w/o oxygen as sintering aids was scaled-up to develop a property data base for use in thermomechanical applications at high (~ 1300°C) temperatures. The fracture strength in 3-pt bend for test bars ~ 0.6 x 0.6 x 4.5 cm was approx. 440 MPa (63,700 psi) for a span length of 3.8 cm. There was little drop (<15%) in high temperature strength at 1400°C in air. The creep resistance was outstanding at 1300 to 1400°C, as evidenced by creep rates of ~ $4 \times 10^{-5} h^{-1}$ for a stress of 207 MPa (30,000 psi) at 1400°C and ~ $2 \times 10^{-6} h^{-1}$ for a stress of 345 MPa (50,000 psi) at 1300°C, and a total creep strain of 0.11% for an Si_3N_4 bar exposed for 650 h under an applied stress of 345 MPa at 1300°C in air. The oxidation rates in oxygen were very low and were 7.4×10^{-13} and 2.1×10^{-12} $Kg^2 m^{-4} S^{-1}$ at 1300 and 1405°C, respectively.

12380 **Method for forming high superconducting T/sub c/ niobium nitride film at ambient temperatures.** Cukauskas, E.J. US Patent Application 6-513,195. 12 Jul 1983. 13p.

This report contains a method of forming a high TC niobium nitride (NbN) film on a substrate at ambient substrate temperature. The method includes the step of reactively sputtering NbN onto the substrate in an argon-nitrogen atmosphere with controlled amounts of methane added to the argon-nitrogen gas mixture.

12381 **Process for preparing fine grain silicon carbide powder.** Wei, G.C. US Patent Application 6-447,576. [nd]. 7p. Contract W-7405-ENG-26.

Method of producing fine-grain silicon carbide powder comprises combining methyltrimethoxysilane with a solution of phenolic resin, acetone and water or sugar and water, gelling the resulting mixture, and then drying and heating the obtained gel.

12382 **Preparation of metal diboride powders.** Brynestad, J.; Bamberger, C.E. US Patent Application 6-488,870. [nd]. 10p. Contract W-7405-ENG-26.

Finely-divided titanium diboride or zirconium diboride powders are formed by reacting gaseous boron trichloride with a material selected from the group of consisting of titanium powder, zirconium powder, titanium dichloride powder, titanium trichloride powder, and gaseous titanium trichloride.

12383 **Process for preparing fine grain silicon carbide powder.** Wei, G.C. US Patent Application 6-461,281. [nd]. 6p. Contract W-7405-ENG-26.

Finely divided silicon carbide powder is obtained by mixing colloidal silica and unreacted phenolic resin in either acetone or methanol, evaporating solvent from the obtained solution to form a gel, drying and calcining the gel to polymerize the phenolic resin therein, pyrolyzing the dried and calcined gel at a temperature in the range of 500 to 1000°C, and reacting silicon and carbon in the pyrolyzed gel at a temperature in the range of 1550 to 1700°C to form the powder.

3603 Composite Materials

12384 (CONF-821055—, pp 291-299) **Fabrication, testing and brazing of dispersed-metal toughened alumina.** Moorhead, A.J.; Becher, P.F.; Lauf, R.J.; Morgan, C.S. (Oak Ridge National Lab., TN). Apr 1983. NTIS, PC A16/MF A01.

From 20. automotive technology development contractors' coordination meeting; Dearborn, MI, USA (25 Oct 1982).

An aluminum oxide based material that contains approximately 1 vol % finely dispersed platinum or chromium was developed for use in high temperature, thermal-shock resistant electrical insulators. These composites are produced by hot-pressing Al_2O_3-Pt or Al_2O_3-Cr powders containing fine metallic particles obtained by in situ reduction of platinum chloride or chromium nitrate. These materials: (1) have high fracture toughness about twice that of conventional alumina; (2) are excellent electrical insulators (resistivity comparable to that of aluminum oxide up to at least 800°C); (3) are highly resistant to repetitive thermal transients of 300°C/s; (4) have greater than 97% of theoretical density; and (5) are readily joinable by brazing to metal components. The improved toughness and thermal shock resistance of these materials are evidently attributable to both the metal particles (that impede and divert cracks) and to a mixed morphology of the alumina grains that also causes crack deflection and branching. Both of these mechanisms are significant as they lead to stable crack growth.

12385 **(SAND—83-1457C) Long-term strength retention of bonded copper-polymer assemblies.** Kunz, S.C.; Martinez, R.J. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 23p. (CONF-8311133—1). NTIS, PC A02/MF A01. Order Number DE84005513.

From 11. DOE compatibility meeting; Livermore, CA, USA (18 Nov 1983).

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The bond strength and long-term bond strength retention of copper-polymer interfaces were investigated. Butt tensile tests were done on bonded assemblies in which copper was bonded to both a rigid polymer and a flexible polymer. The short-term strength of the bonded assemblies is enhanced by surface treatment (brown oxidation) of the copper. Untreated copper promotes low strength adhesive delamination from epoxy, the rigid polymer used in this study. Sustained constant load tests at stresses lower than the initial strengths were done to determine the effect of a flexible layer on the lifetime of a bonded assembly. Substantial strength losses with time under load occurred in bonded assemblies containing a polyester adhesive, the flexible layer used in this study. The assembly lifetime was found to be governed by creep cavitation of the flexible layer. As a result, attempts to ensure long life of a bonded assembly by simply enhancing the bond strength of all the interfaces are shown to be inadequate. Instead, the time-dependent properties of all flexible layers present in a bonded assembly must be factored into design lifetime predictions.

12386 **Erosion-resistant composite material.** Finch, C.B.; Tennery, V.J.; Curlee, R.M. US Patent Application 6-440,194. [nd]. 9p. Contract W-7405-ENG-26.

A highly erosion-resistant composite material is formed of chemical vapor-deposited titanium diboride on a sintered titanium diboride-nickel substrate. This material may be suitable for use in cutting tools, coal liquefaction systems, etc.

3604 Polymers And Plastics

12387 **(NUREG/CR—3532) Response of rubber insulation materials to monoenergetic electron irradiations.** Buckalew, W.H.; Wyant, F.J.; Lockwood, G.J. (Sandia National Labs., Albuquerque, NM (USA)). Nov 1983. Contract AC04-76DP00789. 57p. (SAND—83-2098). NTIS, PC A04/MF A01 - GPO. Order Number DE84005649.

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The electron charge disposition in ethylene-propylene rubber (EPR) insulation specimens irradiated with monoenergetic electrons has been investigated. Studied was charge disposition in slab and cylindrical (cable) geometries. For each geometry, charge behavior was observed as a function of environment, electron energy, and surface termination. Under certain conditions charge was accumulated and spontaneous breakdown did occur during irradiation in the vacuum environment; however, no evidence of breakdown was observed during ambient air exposures. Based on these experiments, it is concluded that electron charge buildup and breakdown is not apt to occur in EPR rubber insulation exposed to electrons from a LOCA radiation environment provided that the insulation is in contact with an ionized medium. The results can probably be applied to other organics and it appears that the LOCA beta spectra need not be precisely duplicated in insulation-radiation qualification tests.

3606 Other Materials

REFER ALSO TO CITATION(S) 11611, 11631, 11724, 11731, 12474, 12599, 12872

12388 **(DOE/CS/83109—T2) Photoemission studies of fluorinated a-Si:H.** Gredin, R.J. (Delaware Univ., Newark (USA). Inst. of Energy Conversion). Dec 1982. Contract FG02-80CS83109. 70p. NTIS, PC A04/MF A01. Order Number DE84005471.

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Ultraviolet photoemission spectroscopy and Auger electron spectroscopy measurements have been made on a-Si:H:F and a-Si:H:F(P) films prepared by the rf glow discharge deposition technique. A novel in-situ deposition/analysis system has been described. The valence band maximum has been found to be 1.1 eV below the Fermi level in a-Si:H:F, and was shifted to about -1.2 eV by the incorporation of 0.7% P atoms into the film. The density of gap states has been determined by photoemission measurements to be less than 1.8×10^{19} states eV^{-1} cm^{-3} in the region from the VBM up to E/sub F/ in a-Si:H:F, while 0.7% P doping produced about 2.5×10^{19} states/cm^3 above the VBM, with a peak state density of 4.7×10^{19} states eV^{-1} cm^{-3} at about 0.6 eV below E/sub F/. The properties of the films were found to be independent of changes in F content ranging from 0.3 to 1.5 at. % in both doped and undoped films. Instabilities in the deposition plasma were found to have little effect on the position of the VBM with respect to E/sub F/, but had a large effect on the work function.

12389 **(DOE/ER/12094—T1) Metal atom diffusion in amorphous silica and at the silica surface. Progress report, December 1, 1982-December 1, 1983.** Garofalini, S.H. (Rutgers--the State Univ., New Brunswick, NJ (USA). Dept. of Ceramics). 1983. Contract AS05-82ER12094. 8p. NTIS, PC A02/MF A01. Order Number DE84005252.

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Objective is to study the effects of local structure, interatomic forces, and atom size on the mobility of metal atoms in amorphous silica and at the silica surface. EXAFS studies of Zn and Pt in silica are reported. (DLC)

12390 **(SAND—83-1416C) Plasma-initiated laser deposition of polycrystalline and monocrystalline silicon films.** Gee, J.M.; Hargis, P.J. Jr.; Carr, M.J.; Tallant, D.R.; Light, R.W. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 15p. (CONF-831174—64). NTIS, PC A02/MF A01. Order Number DE84005527.

From Materials Research Society annual meeting; Boston, MA, USA (14 Nov 1983).

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This paper reports a new method of silicon deposition using the interaction between the radiation from a pulsed ultraviolet excimer laser and the plasma species produced in a glow discharge in silicane (SiH_4). Examination of the deposited film by laser Raman spectroscopy and by transmission electron microscopy revealed that the morphology ranged from polycrystalline silicon at laser fluences of 0.13 to 0.17 J/cm^2 to epitaxial silicon at fluences of 0.4 to 0.6 J/cm^2. Growth rates of 100 nm/min for polycrystalline silicon and 30 nm/min for monocrystalline silicon were achieved.

12391 **(UCID—19959) Ring tensile test of modified Halthane 88-2.** Chiu, I.L. (Lawrence Livermore National Lab., CA (USA)). 19 Dec 1983. Contract W-7405-ENG-48. 13p. NTIS, PC A02/MF A01. Order Number DE84005891.

Seven adhesives, designated Halthanes, have been developed at the Lawrence Livermore National Laboratory. This research deals with the stress-strain behavior of Halthane 88-2 and a surfactant modified version of this adhesive as a function of aging time and temperature. The urethane adhesive, Halthane 88-2, consists of prepolymer 88, curing agent XU-205, FC-430, with 88/12/0.25 weight ratio, respectively. Ring tensile measurements were made on control samples and samples aged at elevated temperatures on a logarithmic time scale. The temperatures were 60°C, 75°C and 100°C, and aged for 3 days, 10 days, and 28 days.

12392 **(UCRL—90218) Chemical treatment of silicate glasses for producing anti-reflection surfaces.** Wirtenson, G.R.; Thomas, I.M.; Brown, N.J.; Wilder, J.G. (Lawrence Livermore National Lab., CA (USA)). 13 Jan 1984. Contract W-7405-ENG-48. 4p. (CONF-840494—1). NTIS, PC A02/MF A01. Order Number DE84005865.

From Topical meeting on optical fabrication and testing; Monterey, CA, USA (18 Apr 1984).

A brief description is given of chemical treatments to reduce fresnel reflectance of BK7 and SiO_2 for high fluence laser applications in the spectral range 0.25 to 1.06 μ.

12393 **Electron and positron planar channeling radiation from diamond.** Datz, S.; Fearick, R.W. (Oak Ridge National Lab., TN (USA)); Park, H.; Pantell, R.H.; Swent, R.L.; Kephart, J.O.; Klein, R.K. (Stanford Univ., CA (USA). Dept. of Electrical Engineering); Berman, B.L. (California Univ., Livermore (USA). Lawrence Livermore National Lab.). *Physics Letters [Section] A;* 96: No. 6, 314-318(11 Jul 1983).

Channeling-radiation spectra have been obtained from a diamond with approx.= 54.5 MeV electrons and positrons. Theoretical calculations are found to fit the experimental results well for electrons, but significant discrepancies exist between theoretical predictions and the positron data.

12394 **Low temperature process for obtaining thin glass films.** Brinker, C.J.; Reed, S.T. US Patent Application 6-473,845. [nd]. 22p. Contract AC04-76DP00789.

A method for coating a substrate with a glass-like film comprises, applying to the substrate an aqueous alcoholic solution containing a polymeric network of partially hydrolyzed metal alkoxide into which network there is incorporated finely powdered glass, whereby there is achieved on the substrate a coherent and adherent initial film; and heating said film to a temperature sufficient to melt said powdered glass component, thereby converting said initial film to a final densified film.

12395 **Chemically durable phosphate glasses and a method for their preparation.** Day, D.E.; Wilder, J.A. Jr. US Patent Application 6-447,847. [nd]. 16p. Contract AC04-76DP00789.

The chemical durability of alkali phosphate glasses is improved by incorporation of up to 23 weight percent of nitrogen. A typical phosphate glass contains: 10 to 60 mole % of Li_2O, Na_2O or K_2O; 5 to 40 mole % of BaO or CaO; 0 to 1 to 10 mole % of Al_2O_3; and 40 to 70 mole % of P_2O_5. Nitrides, such as AlN, are the favored additives.

40 CHEMISTRY

4001 Analytical And Separations Chemistry

REFER ALSO TO CITATION(S) 11440, 11484, 11662

12396 **(AD-A—132640/4) Development of analytical methodology for the measurement of chlorine and bromine in the stratosphere. Final report, 20 November 1980-30 November 1982.** Janghorbani, M. (Massachusetts Inst. of Tech., Cambridge (USA). Nuclear Reactor Lab.). May 1983. 19p. NTIS, PC A02/MF A01.

Suitable methodology based on neutron activation analysis is developed for accurate measurement of chlorine and bromine from balloon flight sampling. The method is applied to measurement of a number of filter and filter extracts. It is shown that analyses carried out on total filter is inaccurate because of the relatively major filer bank contributions. However, analyses carried out on water extracts of filters appear to yield satisfactory measurements.

12397 **(AD-A—133016/6) Evaluation of gas chromatographic methods for analysis of gasoline/oxygenate blends. Interim report Mar 80-Aug 81.** Jones, K.B.; Biela, S.M.; Newman, F.M. (Southwest Research Inst., San Antonio, TX (USA). Army Fuels and Lubricants Research Lab.). Dec 1981. 96p. (AFLRL—143). NTIS, PC A05/MF A01.

The selection/development of a standard gas chromatographic method for the determination of oxygenates in gasoline-oxygenate blends is in keeping with laboratory characterization and specification testing phase of the U.S. Army's alternate fuels program. This report evaluates six different gas chromatographic methods of analysis. These methods involve water extraction of the oxygenated compounds as well as direct injection techniques. Gasoline line samples containing varying amounts of methanol, ethanol, t-butanol, and methyl t-butyl ether (MTBE) were analyzed using each of the analytical methods, when possible. The six methods were employed and evaluated for accuracy and efficiency. In each case, comments have been made pertaining to the applications of each method. The analytical results of the methods are graphically compared. This study resulted in a recommendation to use water extraction with an internal standard to quantitate the C4 and lighter alcohols, while the other oxygenated fuel extenders, such as MTBE, should be determined using a direct-injection method which selectively separates the oxygenates from the hydrocarbons. This work indicates that more work is warranted to develop hydrocarbons methodology which is universally applicable to all of the commonly used oxygenated fuel extenders.

12398 **(CEA-CONF—6775) Determination of $^{239}Pu/^{240}Pu$ isotopic ratio by high resolution alpha-particle spectrometry.** Amoudry, F.; Burger, P. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92 - Montrouge (France)). May 1983. 25p. (In French). (CONF-830539—5). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750430.

From International meeting for radionuclide metrology - alpha particle spectrometry and low level measurement; Harwell, UK (10 May 1983).

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The development of passivated ion-implanted silicon detectors and of very thin alpha-particle sources improves the resolution of alpha-particle spectra and allows to separate energy pics up to now unseparate. The $^{239}Pu/^{240}Pu$ isotopic ratio of a mixture has been measured using the alpha spectrometry deconvolution code DEMO.

12399 **(DOE/PETC/TR—84/3) Photoplate interpretation system employing a visual display monitor for spark source mass spectrometry analyses.** DeSantis, R.R.; Lett, R.G.; Plankey, F.W. (USDOE Pittsburgh Energy Technology Center, PA; Polaroid Corp., Cambridge, MA (USA)). [nd]. 103p. NTIS, PC A06/MF A01. Order Number DE84006051.

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An interactive automated data acquisition/analysis system for processing spark source mass spectrometry photoplates is described. Automated reading of the photoplates was accomplished by interfacing a general purpose microcomputer to a densitometer that was previously used for manual photoplate interpretation. Data acquisition is computer-controlled by custom software. A video terminal provides display of peak profiles and peak locations as the plate is scanned, thereby facilitating operator intervention during the selection of data to be recorded. Subsequent calculations are carried out within the microcomputer using the Hull equation, and the analysis is output on a line printer. 24 references, 12 figures, 3 tables.

12400 **(DPST—82-850) Mercury determinations of organic solutions by inductively coupled plasma-emission spectroscopy.** Coleman, C.J. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 17 Sep 1982. Contract AC09-76SR00001. 8p. NTIS, PC A02/MF A01. Order Number DE84005389.

ICP-ES methods have been extended to include mercury determinations of organic solutions. In xylene solution, the mercury detection limit is 0.018 ppM at the optimal plasma observation height. Mercury has been observed to remain for exceptionally long periods in the sample delivery system. The resulting memory effect can bias subsequent analyses unless a long rinse-out period between analyses is used. ICP-ES mercury determinations of organics will support DWPF programs, particularly the in-tank cesium removal program.

12401 **(PB—84-118827) Evaluation of neutron activation for analysis of metals in fish scales. Administrative report.** Nicholson, L.W.; Seelye, J.G. (Fish and Wildlife Service, Ann Arbor, MI (USA). Great Lakes Fishery Lab.). Jun 1980. 18p. NTIS, PC A02/MF A01.

The presence or temporal changes in concentrations of metals such as arsenic, cadmium, chromium, mercury, nickel, and zinc in Great Lakes fish have frequently been attributed to man's activities. The authors record of metal concentrations in fish, however, is sparse and limited to the last few decades. The majority of these metals occur naturally both in the geological structure and

fish of the Great Lakes. Differences in metal concentrations among localities and fish prevent making any broad statement about the degree of metals contamination that has occurred in the Great Lakes. The authors undertook a study, therefore, to measure metals in fish scales collected from the early 1900s to the present. These data would provide a record through the period of industrialization of the Great Lakes watershed, and, in conjunction with other metals data available in the literature, provide information to help differentiate between natural and man-induced changes of metal concentrations in fish. Nondestructive instrumental neutron-activation analysis (INAA) was chosen as the method. They concluded that analyzing the historical scale collection by neutron-activation analyses was not feasible because most samples contained substantially less than the required weight of scales (200-250 mg).

12402 **(PB—84-119841) Certification of a plutonium metal reference material for chemical analyses.** Le Duigou, Y. (Commission of the European Communities, Luxembourg). [nd]. 19p. (EUR—7789-EN). NTIS, PC E03/MF E03.

The characterization of a plutonium metal reference material with accurately known plutonium content by an EC working group is described applying the established practice for action on actinide reference materials. The working scheme and the base material, viz, high-purity plutonium of French origin, are described, and the results are presented. The reference material number and the certified plutonium metal content are stated. The appendices contain the CBNM report on the activity of the working group, additional information to CEA report R 4949, and a draft certificate.

12403 **(UCRL—90157) Spectrochemical analysis of plutonium using direct current plasma emission spectrometry.** Morris, W.F.; Fadeff, S.K.; Torres, S. (Lawrence Livermore National Lab., CA (USA)). 3 Dec 1983. Contract W-7405-ENG-48. 19p. (CONF-8311119—2). NTIS, PC A02/MF A01. Order Number DE84005207.

From Pu isotopic and metals exchange meeting; Miamisburg, OH, USA (2 Nov 1983).

One year ago, LLNL was just completing the installation of a Direct Current Plasma (DCP) spectrometer for the analysis of Pu and Pu alloys. The installation was completed in December 1982 and has been utilized regularly for Pu analysis since then. This paper discusses the experience with the instrument and some data demonstrating its performance.

12404 **Direct fermentation of cellodextrins to ethanol by 'Candida wickerhamii'.** Freer, S.N.; Detroy, R.W. US Patent Application 6-525,917. 24 Aug 1983. 11p.

This invention relates to a fermentation process useful in the production of ethanol from cellodextrins. An ever-increasing interest in microbial conversion of plant biomass to ethanol has stemmed from the current emphasis on developing alternative fuels. The most prevalent and readily available component of biomass is the cellulose, constituting anywhere from 25 to 50% of the plant material.

12405 **Spectral shape and the components of the background in in vivo neutron capture prompt gamma ray analysis.** Vartsky, D.; Ellis, K.J.; Wielopolski, L.; Cohn, S.H. (Brookhaven National Lab., Upton, NY (USA). Medical Research Center). *Nuclear Instruments and Methods in Physics Research;* **213**: No. 2/3, 437-446(1 Aug 1983).

The shape of the background spectrum and the different contributions to the background in in vivo neutron capture prompt gamma ray analysis have been studied using a ^{252}Cf neutron source. Since the source of background and its contribution varies of different energy regions, the detector shielding and the facility construction materials may be different for each analyzed element. Limits of detection for in vivo measurement of Hg, Ca and N were determined.

4002 Inorganic And Physical Chemistry

REFER ALSO TO CITATION(S) 11671, 12428, 12431, 12438, 12468, 12883, 12968

12406 **(CEA-N—2350) Electrochemical study in molten sodium fluoroborate at 420°C.** Wagner, J.F. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France); Paris-6 Univ., 75 (France)). Jun 1983. 141p. (In French). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84750474.

By analysing the behavior of the electrochemical system Cu (I)/Cu it was possible to study the acid-base properties of molten sodium fluoroborate. The anion of the solvent BF_4^- is shown to undergo a strong dissociation according to the equilibrium $BF_4^- <-> BF_3\ (g) + F^-$, the Ki constant at 420°C being evaluated at 1.58 x 10^{-2} mol kg^{-1} atm. The acidity variations of sodium fluoroborate at this temperature are limited to about two pF units (pKi=1.8). A potentiometric study of the copper, silver and nickel systems showed that the corresponding metallic cations are little complexed by fluoride ions in spite of the strong dissociation of the solvent.

12407 **(DOE/CS/66001—2) ECUT Energy Conversion and Utilization Technologies Program. Heterogeneous catalysis modeling program concept.** Voecks, G.E. (Jet Propulsion Lab., Pasadena, CA (USA)). 15 Aug 1983. Contract AI01-81CS66001. 22p. (JPL-PUB—83-89). NTIS, PC A02/MF A01. Order Number DE84005746.

Insufficient theoretical definition of heterogeneous catalysts is the major difficulty confronting industrial suppliers who seek catalyst systems which are more active, selective, and stable than those currently available. In contrast, progress has been made in tailoring homogeneous catalysts to specific reactions because more is known about the reaction intermediates promoted and/or stabilized by these catalysts during the course of reaction. However, modeling heterogeneous catalysts on a microscopic scale requires compiling and verifying complex information on reaction intermediates and pathways. This can be achieved by adapting homogeneous catalyzed reaction intermediate species, applying theoretical quantum chemistry and computer technology, and developing a better understanding of heterogeneous catalyst system environments. Such a total effort is beyond the scope of non-unified universities' research and must also involve an understanding of catalyst preparation and practical experience peculiar only to industry. Research in microscopic reaction modeling is now at a stage where computer modeling, supported by physical experimental verification, could provide information about the dynamics of the reactions that will lead to designing supported catalysts with improved selectivity and stability. Industrial users agree that efforts to find catalysts which will reduce energy consumption and meet the requirements of various future feedstocks must be accelerated as conventional fuels become increasingly scarce and expensive to use. 34 references.

12408 **(DOE/CS/83103—T1) Kinetics of silylene reactions with applications to the homogenous decomposition of monosilane. Final report, June 1, 1980-December 31, 1982.** Ring, M.A.; O'Neal, H.E. (San Diego State Univ., CA (USA). Dept. of Chemistry). 1983. Contract FG02-80CS83103. 25p. NTIS, PC A02/MF A01. Order Number DE84005236.

This report is divided into four sections: an additivity scheme for estimating the heats of formation, entropies, and heat capacities of silanes, polysilanes, and their alkyl derivatives; kinetics and mechanism of shock-induced pyrolysis of hydrosilanes; static-system pyrolysis of SiH_4 and CH_3SiH_3; and mechanism and kinetics of homogeneous gas-phase pyrolysis of methylgermanes. (DLC)

12409 **(DOE/CS/84051—T1) Rate processes in cycling a reversible gas-solid reaction.** Stanish, M.A.; Perlmutter, D.D. (Pennsylvania Univ., Philadelphia (USA). Dept. of Chemical Engineering). [nd]. Contract FG02-80CS84051. 31p. NTIS, PC A03/MF A01. Order Number DE84005280.

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Rate studies are reported of the effect of rehydration-dehydration cycling on the vapor hydration behavior of solid K_2CO_3. Isothermal rate data were obtained at different temperatures and water vapor pressures for the reaction of narrowly-sized anhydrous particles. Effects of different particle preparation histories on the rehydration rate were investigated and correlations of rate with particle pore structure explored. Rehydration rates of dehydrated K_2CO_3. $3/2H_2O$ were found to depend on the conditions of the prior dehydration. Rehydration is comparattively very slow at relative pressures below P/P/sub eq/ $\simeq$ 1.5; rates increase linearly with pressure above P/P/sub eq/ $\simeq$ 3. Hydration rates of K_2CO_3 particles obtained as anhydrous are substantially slower than those of identically-sized particles produced by prior dehydration of K_2CO_3. $3/2H_2O$ crystals; after one rehydration-hydration cycle, rehydration rates of the former are increased by as much as two orders of magnitude and this distribution between particles from different soures virtually disappears. Diffusional resistances based on calculated water vapor diffusivities cannot alone account for the observed effects of cycling.

12410 **(DOE/CS/84051—T2) Kinetics of hydration-dehydration reactions considered as solid transformations.** Stanish, M.A.; Perlmutter, D.D. (Pennsylvania Univ., Philadelphia (USA). Dept. of Chemical Engineering). 1982. Contract FG02-80CS84051. 34p. NTIS, PC A03/MF A01. Order Number DE84005470.

A mechanism is proposed for the dehydration-rehydration process in solid inorganic salts and model rate equations are derived and applied to the observed behavior of potassium carbonate. Quantitative expressions for the effect of pressure on the reaction rates are derived using basic principles from nucleation and heterogeneous phase transformation theory. Model equation predictions agree with experimental dehydration and rehydration rate data at all but extreme pressures. The basic rate equation is also used to interpret the data of Eckhardt and Flanagan (1964) for the effect of pressure on the dehydration of manganous formate dihydrate. The mechanism on which the model equations are based is also consistent with the observed effects of cycling and of high temperatur pretreatment on the K_2CO_3 rehydration rate.

12411 **(NP—4770153) Improved model calculations for the alkali-rare gas interaction.** Dueren, R.; Moritz, G. (Max-Planck-Institut fuer Stroemungsforschung, Goettingen (Germany, F.R.)). Jun 1980. 24p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84770153.

The alkali-rare gas potentials are recalculated using the Baylis model for the electronic interaction. Discrepancies with experimental results found in earlier applications of this model are due mainly to numerical approximations. A more realistic cutoff function for the polarization term is introduced and its influence is investigated. For Na-Ne the model fails to reproduce the experimental results. For the $A\ ^2\pi$-potential of Na-Ar, Kr and Xe the remaining discrepancies, which are now entirely due to the model, are 10% - 30% for the well depth and 10% for the equilibrium distance.

12412 **(RHO-BW-SA—299-P) Computer code for producing Eh-pH plots of equilibrium chemical systems.** Drewes, D.R. (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). Apr 1983. Contract AC06-77RL01030. 21p. NTIS, PC A02/MF A01. Order Number DE84005682.

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This paper describes a computer code that produces high-quality Eh-pH diagrams by coupling the power of the computer for handling extensive calculations with modern digital graphics hardware. The code, called EHPH, is written in standard FORTRAN 77, and has been designed to offer the user considerable flexibility as well as ease of use. The code produces three plots for each problem submitted: (1) a plot of the regions of stability for the stable solid species, (2) a plot of the regions of dominance of the dominant aqueous species, and (3) a contour plot of the total solubility of all species. The DISSPLA graphics package is employed in production of the plots.

12413 **Metrical characterization of tridentate tetrahydroborate ligation to a transition-metal ion. Structure and bonding in $Hf(BH_4)_4$ by single-crystal neutron diffraction.** Broach, R.W. (Argonne National Lab., IL); Chuang, I.S.; Marks, T.J.; Williams, J.M. *Inorganic Chemistry;* 22: No. 7, 1081-1084(30 Mar 1983). Contract W-31-109-ENG-38.

This paper reports the molecular structure of the transition-metal tetrahydroborate complex $Hf(BH_4)_4$ by single-crystal neutron diffraction at 110 K. The compound crystallizes in the cubic space group P43m (T/sub d/^{1}, No. 215) with a unit cell of dimensions a = 5.827 (4) angstrom. Full-matrix least-squares refinement gave a final value of $R(F_o^2) = 0.103$ for 71 unique reflections with $F_o^2 > \sigma(F_o^2)$. The molecular structure consists of monomeric $Hf(BH_4)_4$ units having rigorously T/sub d/ symmetry and tridentate tetrahydroborate coordination. Important bond distances are Hf-B = 2.281 (8) angstrom, Hf-H(bridging) = 2.130 (9) angstrom, B-H(bridging) = 1.235 (10) angstrom, and B-H(terminal) = 1.150 (19) angstrom. Important bond angles are Hf-H(bridging)-B = 80.6 (6)°, H(bridging)-B-H(bridging) = 105.8 (6)°, and H(bridging)-B-H(terminal) = 112.9 (10)°. It is seen that the internal BH_4^- metrical parameters do not differ significantly from those in $Hf(CH_3C_5H_4)_3(BH_4)_3$, in which the tetrahydroborate ligands are coordinated in an unsymmetrical bidentate fashion. However, Hf-B is 0.17 (1) angstrom longer and Hf-H(bridging, average) 0.035 (9) angstrom shorter in the latter molecule.

12414 **Improved process for generating ClF_3 from ClF and F_2.** Reiner, R.H.; Pashley, J.H.; Barber, E.J. US Patent Application 6-387,064. [nd]. 19p. Contract W-7405-ENG-26.

The invention is an improvement in the process for producing gaseous ClF_3 by reacting ClF and F_2 at elevated temperature. The improved process comprises conducting the reaction in the presence of NiF_2, which preferably is in the form of particles or in the form of a film or layer on a particulate substrate. The nickel fluoride acts as a reaction catalyst, significantly increasing the reaction rate and thus permitting valuable reductions in process temperature, pressure, and/or reactor volume.

4003 Organic Chemistry

REFER ALSO TO CITATION(S) 12407, 12428, 12438, 12468, 12967

12415 **(LBL—12675) Investigation of methods for the selective removal and characterization of transition metals associated with solids in the marine environment.** Van Valin, R.; Morse, J.W. (Miami Univ., FL (USA). Rosenstiel School of Marine and Atmospheric Sciences). Feb 1981. Contract W-7405-ENG-48. 61p. NTIS, PC A04/MF A01. Order Number DE84004403.

The operation of an OTEC plant will result in the mixing of large volumes of seawater from different depths within the ocean. Because suspended particulate material is intimately involved in marine food webs and transition metals, such as copper, can have toxic effects, it is important to develop a sound methodology for characterizing and quantifying transition metal behavior associated with the solid material. The characterization of solid-phase-associated transition metals in the marine environment has largely been directed at marine sediments. These studies have generally indicated that it is not possible to uniquely identify the solid phases or chemical speciation of a given metal. There are many reasons for this difficulty, but the probable major analytical problems arise from the fact that many of the transition metals of interest are present only in trace concentrations as adsorbed species on amorphous oxides or as coprecipitates. In one approach transition metals are classified according to how easily they are solubilized when exposed to different types of chemical attack, as defined in chemical extraction schemes. In this study, several of the most widely accepted extraction techniques were compared for many of the most commonly measured transition metals to a variety of marine sediments. Based on the results of this study, the sequential extraction scheme of Tessler et al. (1979) is the recommended method for the characterization of solid-phase associated transition metals. An increase of the reducing agent concentration in the intermediate step and temperature decrease with an additional HCl digestion in the residual

step are recommended as improvements, based on the results of the individual extraction method studies.

12416 **(LBL—12959) Interaction of copper with the surface of calcite.** Franklin, M.L.; Morse, J.W. (Lawrence Berkeley Lab., CA (USA)). May 1981. Contract W-7405-ENG-48. 38p. NTIS, PC A03/MF A01. Order Number DE84004402.

The interaction of Cu ions in solution with the surface of calcite has been studied in a range of solutions from pure water to seawater. Observations of the uptake of Cu from solution onto calcite indicates that the process is rapid and strong in both distilled water and seawater. In distilled water, Cu uptake is directly proportional to the concentration of Cu in solution; Cu/sub s/ = K/sub s/Cu_i. This Cu/sub s/ dependence on Cu_i is linear over the entire Cu concentration range studied (0.1 to 200 μM). Results do not indicate the formation of a precipitate of either malachite or copper carbonate. In seawater, the uptake of Cu is also directly proportional to the concentration of Cu_i up to a limiting value of approximately 13 μM. The average value for K/sub s/ in seawater, 0.24 +- 0.06 ($Cu_i \leq 13$ μM), is approximately an order of magnitude less than in distilled water. This is probably the result of smaller Cu_i activity coefficients and increased site competition by other ions in seawater. Attempts to increase the Cu_i concentration above 13 μM resulted in the additional Cu being deposited on the surface of the calcite. A possible explanation for this behavior is the formation of a precipitate of malachite on the calcite surface. The value of K/sub s/ decreased slightly with increasing solid to solution ratios in seawater.

12417 **(PB—83-250282) Thermal degradation of model fire-retarded urethane foams: an analytical study--2.** Einhorn, I.N.; Ramakrishnan, M.S.; Mickelson, R.W. (Utah Univ., Salt Lake City (USA). Flammability Research Center). 24 Sep 1976. 74p. NTIS, PC A04/MF A01.

The products of degradation of both fire-retardant and non-fire-retardant model rigid-urethane foams were studied. A series of model rigid-urethane foams was prepared and all samples were pyrolyzed at temperature of 500, 750, and 1000C. Gas chromatograph columns were used to separate the volatile products. It was found that as pyrolysis temperature increased, the mechanism of degradation of urethane foam remained unchanged. The breakage of urethane bond, releasing carbon dioxide, was the major reaction. With an increase in temperature, the polyol component degraded further to form light gases. With the addition of fire retardant, the nature of pyrolysis products was altered slightly. Although the basic degradation mechanism remained unchanged, the fire retardant catalyzed the reactions, leading to the formation of certain noxious and light gases.

12418 **Crescent-shaped dinuclear complexes: a dirhodium(II) complex of the new tetradentate ligand 2,7-bis(2-pyridyl)-1,8-naphthyridine (bpnp), $[Rh_2(bpnp)(\mu\text{-}CH_3CO_2)_3](PF_6)$.** Tikkanen, W.R.; Binamira-Soriaga, E.; Kaska, W.C.; Ford, P.C. (Univ. of California, Santa Barbara). *Inorganic Chemistry;* 22: No. 7, 1147-1148(30 Mar 1983).

There is considerable interest in ligand systems that can coordinate two metal centers in close proximity. Such dinuclear complexes may show unusual properties and synergism between the two metals. Described here are the synthesis, spectral characterization, and structure of the first dinuclear complex of the tetradentate ligand 2,7-bis(2-pyridyl)-1,8-naphthyridine (bpnp). The title complex is a derivative of the extensively studied dirhodium(II) tetrakis(μ-carboxylates) and represents the first example of a $LRh_2(O_2CR)_3^+$ ion where L is a neutral bridging ligand. The electrochemistry of this complex is unusually rich, showing not only a reversible one-electron oxidation but also two reversible one-electron reductions in contrast to the tetracarboxylates that undergo irreversible reduction. The combination of the relatively rigid tetradentate ligand and the two metal atoms is crescent shaped (i.e., a "croissant complex"), thus minimizing the steric effects on the metal centers in potential catalytic interactions with substrate molecules.

12419 **Chemistry of triosmium carbonyl cluster compounds and its implications for catalysis.** Adams, R.D. (Yale Univ., New Haven, CT). *Accounts of Chemical Research;* 16: No. 2, 67-72(Feb 1983).

A study was undertaken of the chemistry of a series of triosmium carbonyl cluster complexes formed by the addition of a variety of small heteronuclear unsaturated molecules to the cluster complex $H_2Os_3(CO)_{10}$. Results taken collectively reveal a pattern of ligand transformations influenced by polynuclear ligand coordinations, metal-metal bond cleavages, and facile ligand shifts between metal atoms. Many of these features can have no parallel in the chemistry of mononuclear metal complexes. On the other hand, they may have many similarities to the types of processes that occur at multinuclear metal sites on surfaces. In conclusion, there is considerable reason to expect that cluster compounds do have sufficiently unique chemical properties to allow them to be developed as a new class of reaction catalysts.At the same time they may also serve as viable models for ligand structure, bonding, and reactivity on metal surfaces.

4004 Electrochemistry

REFER ALSO TO CITATION(S) 12406, 12418, 12431

12420 **(DOE/ER/02960—T2) Electrode polarization studies in hot corrosion systems. Progress report, 1 June 1983-31 May 1984.** Devereux, O.F. (Connecticut Univ., Storrs (USA). Dept. of Metallurgy). Jan 1984. Contract AC02-76ER02960. 41p. NTIS, PC A03/MF A01. Order Number DE84005485.

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The research consisted of studies of anodic film formation in molten sulfides, and of the deterioration of refractory oxide films in sulfide-containing molten salts. Progress is reported on the following tasks: electrode polarization studies in molten Na_2CO_3, dissolution of refractory oxides by molten sulfides, anodic sulfide coatings, and gas/metal reactions in mixed oxidants.

12421 **Electrochemistry of mixed-metal bimetallic complexes containing the pentacyanoferrate(II) or pentaammineruthenium(II) metal center.** Moore, K.J.; Lee, L.; Mabbott, G.A.; Petersen, J.D. (Clemson Univ., SC). *Inorganic Chemistry;* 22: No. 7, 1108-1112(30 Mar 1983). Contract AS09-80ER10671.

The electrochemistry of a series of mixed-metal bimetallic complexes of the type $B_5MLM'B'_5$, where $B_5M = (CNN)_5Fe$/sup II/ or $(NH_3)_5Ru$/sup II/, L = pyrazine, 4,4'-bipyridine, or 4-cyanopyridine, $M'B'_5$ = Rh/sup III/$(NH_3)_5$ or Co/sup III/$(CN)_5$, is reported. The bimetallic complexes all have metal-to-ligand charge-transfer (MLCT) bands associated with the M-B unit (d/sub π/M $\rightarrow$ p/sub π/*L). The effect of the remote metal center, $M'B'_5$, is to function as a Lewis acid, shifting the MLCT maximum to lower energy and shifting the M/sup III///sup II/ reduction potential more positive with respect to free B_5ML. The remote metal influence is attenuated by longer bridging ligands and by reduced π-overlap. A comparison of the electrochemical data of the mixed-valence Fe(II)/Fe(III) and Ru(II)/Ru(III) complexes to the mixed-metal Fe(II)/Co(III) and Ru(II)/Rh(III) complexes has enabled a quantitative measure of the stabilization due to electron delocalization in the mixed-valence complexes. The results show that electron delocalization is greater for the ruthenium complexes than for the iron complexes, is a small contributor to the total stabilization of the mixed-valence state, and even in ruthenium drops off rapidly as the length of the bridge increases.

12422 **Super ionic conductive glass.** Susman, S.; Volin, K.J. US Patent Application 6-445,597. [nd]. 17p. Contract W-31-109-ENG-38.

Described is an ionically conducting glass for use as a solid electrolyte in a power or secondary cell containing an alkali metal-containing anode and a cathode separated by an alkali metal ion conducting glass having an ionic transference number of unity and the general formula: A/sub 1 + x/D/sub 2-x/3/Si/sub x/P/sub 3 - x/O/sub 12 - 2x/3/, wherein A is a network modifier for the glass

and is an alkali metal of the anode, D is an intermediate for the glass and is selected from the class consisting of Zr, Ti, Ge, Al, Sb, Be, and Zn and X is in the range of from 2.25 to 3.0. Of the alkali metals, Na and Li are preferred and of the intermediate, Zr, Ti and Ge are preferred.

4005 Photochemistry

REFER ALSO TO CITATION(S) 11674

12423 (DOE/ER/10540—T1) Development of a photochemical energy storage system. Final technical report, September 1, 1979-November 30, 1982. Kutal, C.; King, R.B. (Georgia Univ., Athens (USA). Dept. of Chemistry). 1982. Contract FG02-79ER10540. 14p. NTIS, PC A02/MF A01. Order Number DE84005242.

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An attractive strategy for photochemical energy storage involves the use of endoergic photorearrangements of organic molecules. By far the most promising system of this type involves the inter-conversion of norbornadiene, NBD, and quadricyclene, Q. Although NBD is transparent in the spectral region of abundant solar radiation (> 300 nm), the photoreaction does occur at longer wavelengths in the presence of an appropriate spectral sensitizer with an overall quantum efficiency of Q production approaching 100% in optimal cases. The specific energy storage capacity, ~ 250 cal per gram (~ 1 x 10^6 joule/kg) of Q produced, is larger than the common thermal storage materials. Long-term energy storage is realized, since Q is indefinitely stable toward reversion to NBD under ordinary conditions. Addition of an appropriate catalyst, however, causes rapid (within seconds) conversion of Q to NBD with the release of the stored energy as heat. Quantum efficient sensitizers are needed which absorb strongly in the visible wavelength region and are thermally and photochemically stable such as silica-functionalized organic photosensitizers. Furthermore, while several catalysts for the reverse reaction are known, it would be advantageous to have ones which are relatively inexpensive and ones which would offer a range of catalytic activity in order to select the optimal rate for the reconversion at ambient temperatures. Transition metal catalysts such as cobalt were tested. Finally, there are substantial benefits which arise from spatially confining the sensitizer and reversion catalyst to their appropriate sections in a functional energy storage system. Immobilization of each component onto separate heterogeneous supports offers an attractive method for accomplishing this. Our research group has been actively involved in each of these areas since 1975. Accomplishments during the three-year period covered by the present grant are reviewed in this report. (DMC)

12424 (DOE/ER/12039—1) Particulate models of photosynthesis. Seely, G.R. (Charles F. Kettering Research Lab., Yellow Springs, OH (USA)). Nov 1983. Contract AC02-82ER12039. 15p. NTIS, PC A02/MF A01. Order Number DE84003947.

Continued support is requested for a program to study the photochemical and photophysical properties of chlorophyll adsorbed together with various surfactants to particles of polyethylene swollen with low molecular weight hydrocarbon diluents. The general objectives of the program are: (1) to discover and optimize photochemical reactions for separation of oxidized and reduced products into different phases; (2) to further characterize association of chlorophyll and other amphiphilic substances on the particle surface; and (3) to improve the methods of studying photoprocesses in optically dense scattering media. More specifically, an analog of Photosystem II of photosynthesis will be developed, in which quinones will be reduced in the particle phase, and reductants oxidized in the aqueous suspending phase. Also, diacylindigos will be investigated as all-purpose probes for photoprocesses in heterogeneous systems. Results to date have shown that the forms of chlorophyll association are specific to the surfactant, that the chlorophyll species are often strongly fluorescent at room temperature, and that the particular systems are capable of a vigorous and sometimes novel photochemistry. (From the Request for Continuation, September 1982).

12425 Photochemistry of 9,10-anthraquinone-2-sulfonate in solution. 1. Intermediates and mechanism. Loeff, I. (Hebrew Univ., Jerusalem, Israel); Treinin, A.; Linschitz, H. *Journal of Physical Chemistry;* 87: No. 14, 2536-2544(7 Jul 1983).

The photochemistry of aqueous 9,10-anthranquinone-2-sulfonate (AQS) was investigated by using four different approaches: (1) laser photolysis of AWS in water as a function of concentration and pH; (2) laser photolysis of AQS in CH_3CN and CH_3CN/H_2O mixtures, combined with emission spectroscopy; (3) steady-state photolytic study of the effect of AQS concentration and pH on the yield of photohydroxylation in water; (4) quenching of intermediates in inhibition of photohydroxylation by inorganic anions. Our results lead to identification of triplet AQS (tau ~ 100 ns in water) and two other intermediates (B and C) which are formed by two parallel reactions of triplet AQS with H_2O. The nature of these intermediates is still uncertain, but evidence is presented to rule out H abstraction or net electron transfer (even in the case of OH^-) leading to formation of free OH radicals. The possibility that B and C are two different water adducts is discussed. The role of referential solvation of AQS in CH_3CH/H_2O mixures in determining its photochemistry is also examined. Species C (λ/sub max/ ~ 600 nm) is the only transient observed which appears to react with ground-state AQS, and this reaction is considered to be responsible for photohydroxylation. Our results provide direct evidence for the validity of the "^{3}AQS/H_2O" mechanism proposed by Clark and Stonehill (CS), in which the primary step is reaction of ^{3}AQS with water (and not with ground-state AQS) to produce the hydoxylation agent. However, this mechanism is modified for pH≧11 by proposing another hydroxylating agent which may be AQS^-.OH exciplex (or radical pair) produced by charge-transfer (CT) quenching of ^{3}AQS by OH^-. Evidence is presented to establish the charge-transfer nature of quenching of triplet AQS by various anions including OH^-.

12426 Ultraviolet irradiation of municipal wastewater: evaluation of effects on organic constituents. Lee, N.E.; Jolley, R.L.; Denton, M.S.; Thompson, J.E. (Oak Ridge National Lab., TN). *Environment International;* 7: 403-408(1982). Contract W-7405-ENG-26.

A comparison of chromatograms derived from the UV-absorbing and oxidizable constituents present in primary and secondary municipal wastewater effluents indicates that exposure to UV irradiation at disinfection levels results in only slight chemical changes. The most pronounced chemical effects to nonvolatile organic constituents in wastewater effluents have been observed at irradiation levels in excess of those necessary for disinfection. Aliquots of effluents before and after exposure to varying levels of UV irradiation were concentrated by lyophilization prior to liquid chromatographic (LC) analysis. Anion-exchange chromatographic techniques utilizing a modified ultraviolet detector coupled in a series with a cerate oxidative monitor provided excellent resolution and sensitivity in the determination of chemical changes occurring in the effluents as a result of exposure to different irradiation levels. The total coliform counts for each irradiated effluent were determined by the membrane-filter technique to evaluate the effectiveness of UV irradiation as a disinfection process for municipal wastewaters. Changes in biochemical oxygen demand (BOD), chemical oxygen demand (COD), total organic carbon (TOC), and total Kjeldahl nitrogen (TKN) at different levels of exposure to UV irradiation are presented. The results of these determinations and the gas chromatography/mass spectrometry data characterizing the observed chemical changes are discussed.

4006 Radiation Chemistry

REFER ALSO TO CITATION(S) 11623, 11692

12427 (LBL—16812) Reaction mechanisms in the radiolysis of peptides, polypeptides and proteins II reactions at side-chain loci in model systems. Garrison, W.M. (Lawrence Berkeley Lab., CA (USA)). Nov 1983. Contract AC03-76SF00098. 46p. NTIS, PC A03/MF A01. Order Number DE84005877.

The major emphasis in radiation biology at the molecular level has been on the nucleic acid component of the nucleic acid-protein complex because of its primary genetic importance. But there is increasing evidence that radiation damage to the protein component also has important biological implications. Damage to capsid protein now appears to be a major factor in the radiation inactivation of phage and other viruses. And, there is increasing evidence that radiation-chemical change in the protein component of chromation leads to changes in the stability of the repressor-operator complexes involved in gene expression. Knowledge of the radiation chemistry of protein is also of importance in other fields such as the application of radiation sterilization to foods and drugs. Recent findings that a class of compounds, the α,α'-diaminodicarboxylic acids, not normally present in food proteins, are formed in protein radiolysis is of particular significance since certain of their peptide derivatives have been showing to exhibit immunological activity. The purpose of this review is to bring together and to correlate our present knowledge of products and mechanisms in the radiolysis of peptides, polypeptides and proteins both aqueous and solid-state. In part 1 we presented a discussion of the radiation-induced reactions of the peptide main-chain in model peptide and polypeptide systems. Here in part 2 the emphasis is on the competing radiation chemistry at side-chain loci of peptide derivatives of aliphatic, aromatic-unsaturated and sulfur-containing amino acids in similar systems. Information obtained with the various experimental techniques of product analysis, competition kinetics, spin-trapping, pulse radiolysis, and ESR spectroscopy are included.

12428 **The cyclopentylpentaaquochromium(III) ion: synthesis, characterization, and kinetics of acidolysis, homolysis, and electrophilic cleavage reactions.** Espenson, J.H. (Iowa State Univ., Ames); Connolly, P.; Meyerstein, D.; Cohen, H. *Inorganic Chemistry*; 22: No. 7, 1009-1913(30 Mar 1983).

The complex $[(H_2O)_5Cr\text{-}c\text{-}C_5H_9]^{2+}$ is formed in the reaction of Cr^{2+} with H_2O_2 in aqueous solution saturated with cyclopentane. Reaction of Cr^{2+} with cyclopentyl radical, a step observed directly by pulse radiolysis ($k = (8.0 +/- 1.0) \times 10^7\ M^{-1}\ s^{-1}$), yields $(H_2O)_5Cr\text{-}c\text{-}C_5H_9^{2+}$, the radical being formed by abstraction from the hydrocarbon with HO.. The complex was isolated chromatographically and characterized by its absorption spectrum and the products of reactions (C_5H_9Br from Br_2, C_5H_9OH from homolysis in the presence of Fe^{3+} and Cu^{2+}). It decomposes by parallel unimolecular pathways of acidolysis ($\rightarrow CrOH^{2+} + c\text{-}C_5H_{10}$, $k_{298} = (4.86 +/- 0.12) \times 10^{-4}\ s^{-1}$, $\Delta H^* = 73.5 +/- 2.4$ kJ mol^{-1}, $\Delta S^* = -61.5 +/- 7.9$ J mol^{-1} K^{-1} and homolysis ($\rightarrow Cr^{2+} + .C_5H_9$, $k_{298} = (1.07 +/- 0.16) \times 10^{-4}\ s^{-1}$, $\Delta H^* = 126 +/- 2.9$ kJ mol^{-1}, $\Delta S^* = 102.5 +/- 9.3$ J mol^{-1} K^{-1}), although the latter is a reversible and thermodynamically unfavorable process, which occurs only in the presence of oxidizing agents. The complex also reacts in bimolecular displacement reactions (S/sub E/2 mechanism) with Hg^{2+} ($k_{298} = 1.08 +/- 0.20\ M^{-1}\ s^{-1}$), Br_2 ($k_{298} = 1.30 +/- 0.19 \times 10^4\ M^{-1}\ s^{-1}$), and I_2 ($k_{298} = 8.2\ M^{-1}\ s^{-1}$).

4007 Radiochemistry And Nuclear Chemistry

REFER ALSO TO CITATION(S) 11600, 11601, 11602, 11604, 11641

12429 **(AD-A—133836/7) Application of quantum chemistry to atmospheric chemistry. Annual report, 1 October 1981-30 September 1982.** Krauss, M.; Stevens, W.J. (National Bureau of Standards, Washington, DC (USA). Quantum Chemistry Group). 30 Sep 1982. 31p. NTIS, PC A03/MF A01.

Relativistic effective potentials have been used to calculate the electronic structure and spectroscopic properties of UO+. The excitation energies of the excited states of UO+ were calculated using a restricted valence configuration interaction. Strong radiative transitions are predicted in the red part of the visible. These transitions are predominately atomic-like f to d.

12430 **(AECL—7800) Reference guide to SOLMNQ: an interactive solution-mineral equilibrium program.** Goodwin, B.W.; Munday, M. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). Dec 1983. 99p. AECL-Scientific Document Dist. Office, Chalk River, Ontario, Canada KOJ 1JO $4.00.

Work performed under the Canada/US Waste Management Information Exchange Agreement.

SOLMNQ is an interactive chemical speciation program that calculates equilibrium distributions for a variety of inorganic aqueous species often found in natural groundwaters. The input to the program is the chemical composition of a hypothetical or real groundwater, including the groundwater pH and oxidation potential (where redox reactions are significant), and the temperature of the analysis. The output from the program is the calculated equilibrium concentrations of aqueous species and complexes, and the degree of saturation of a number of common solids and minerals. SOLMQ is a FORTRAN version of the PL-I program SOLMNEQ (Y.K. Kharaka and I. Barnes, SOLMNEQ: Solution-Mineral Equilibrium Computations, US Geological Survey Computer Contribution PB 215-899 (1973)) with an extended database that includes uranium and plutonium aqueous and solid species. A number of modifications have been made to the logic of SOLMNEQ, including the addition of an interactive capability, the addition of uranium and plutonium solubility determinations, and modifications to improve the speed and accuracy of the iteration algorithm. For most applications, the interactive nature of SOLMNQ should make its use straightforward. This report is intended to serve as a guide to users who wish to run unusual applications, or who desire a more detailed understanding of the program. 23 references, 5 figures, 2 tables.

12431 **(CEA-N—2353) Electrochemical study of uranium in the sodium fluoroborate. Sodium fluoride eutectic at 420°C.** Gadri, A. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). Jul 1983. 142p. (In French). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84750473.

The study of molten sodium fluoroborate properties is divided into two parts. First the preparation of the solvent is reported. To reduce the oxygen content of $NaBF_4$ to a minimum, the salt is recrystallized in dilute hydrofluoric solution (0.5 to 1.5 M). The final product contains 500 ppm oxygen. The electrochemical study of uranium in the $NaBF_4$-NaF eutectic led to the conclusion that U(VI) and U(IV) make up a single electrochemical system. Given the forms in which U(VI) ($UO_2F_4^{2-}$) and U(IV) (UF_6^{2-}) exist, the oxidation-reduction process involves the oxygenated species present in the molten salt. The kinetics of this process depends on the nature of the electrode used.

12432 **(KFK—3403) Research and development activities of the Institut fuer Nukleare Entsorgungstechnik on the decontamination of surfaces.** Dippel, T.; Hentschel, D.; Kunze, S. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Nukleare Entsorgungstechnik). Jun 1983. 42p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84750078.

After developing a procedure for the "Testing of Surface Coating Materials for the Decontamination" about 900 different surface coating materials had been tested and evaluated for the domestic and foreign industry. The results prove the following basic facts: Surface coatings, low in porosity, forming a smooth surface and containing limited amounts of filler are in the majority very effectively decontaminated if they are prepared of chemically stable, water repellent materials; Decontamination results are drastically poorer if the degree of filling of the materials is high especially if hygroscopic fillers and/or hygroscopic colouring matters are used. Currently available cleansers and washing powders used for decontamination did not fulfill the three basic demands for a decontamination agent: high efficiency, small foam generation and sufficient thermal stability. Therefore for the decontamination of walls, floors, etc. a water delutable, liquid cleanser was developed. In the same context a washing powder was optimized for the decontamination of contaminated clothing. The experiments on the decontamination of stainless steels ended up with the formulation of a pickling paste. Furthermore all investigations were aimed at a minimization of the waste generation by the decontamination process. This resulted in decontamination techniques, in which the decontaminating agents were applied in thin layers. A comparison of the currently practiced dipping technique with the coating technique showed that the latter one gave the better decontamination results and that the amount of decontamination waste was reduced.

12433 **Isotopic generator for ^{212}Pb and ^{212}Bi.** Zucchini, G.L. (University of Ferrara (Italy)); Friedman, A.M. (Argonne National Laboratory, Illinois (USA)). pp 2110-2111 of Nuclear medicine and biology. Proceedings Vol. 2. Raynaud, C. (ed.). Paris, France; Pergamon (1982). (CONF-820804—Vol.2).

From 3. world congress of nuclear medicine and biology; Paris, France (29 Aug 1982).

Published in summary form only.

12434 **Process for the production of ^{18}F-2-deoxy-2-fluoro-d-glucose.** Shiue, C.Y.; Salvadori, P.A.; Wolf, A.P.; Fowler, J.S.; MacGregor, R.R. US Patent Application 6-469,597. [nd]. 9p. Contract AC02-76CH00016.

Process is given for the production of 2-deoxy-2-fluoro-D-glucose and the corresponding ^{18}F-compound by the reaction of acetyl hypofluorite or the corresponding ^{18}F-compound with 3,4,6-tri-0-acetyl-D-glucal followed by hydrolysis. Process includes the production of the hypofluorite compound at ambient temperature.

12435 **Method for producing ^{67}Cu.** O'Brien, H.A. Jr.; Barnes, J.W.; Taylor, W.A.; Thomas, K.E.; Bentley, G.E. US Patent Application 6-477,459. [nd]. 18p. Contract W-7405-ENG-36.

A method of producing carrier-free ^{67}Cu by proton spallation combined with subsequent chemical separation and purification is disclosed. A target consisting essentially of pressed zinc oxide is irradiated with a high energy, high current proton beam to produce a variety of spallogenic nuclides, including ^{67}Cu and other copper isotopes. The irradiated target is dissolved in a concentrated acid solution to which a palladium salt is added. In accordance with the preferred method, the spallogenic copper is twice coprecipitated with palladium, once with metallic zinc as the precipitating agent and once with hydrogen sulfide as the precipitating agent. The palladium/copper precipitate is then dissolved in an acid solution and the copper is separated from the palladium by liquid chromatography on an anion exchange resin.

4008 Combustion, Pyrolysis, And High-temperature Chemistry

12436 **(AD-A—132140/5) Combustion chemistry of chain hydrocarbons.** Dryer, F.L.; Glassman, I. (Princeton Univ., NJ (USA). Dept. of Aerospace and Mechanical Sciences). Sep 1977. 63p. NTIS, PC A04/MF A01.

The current understanding of the combustion chemistry of paraffin hydrocarbons is summarized. Emphasis is placed on reviewing the semiempirical methods presently available for modelling alkyl hydrocarbon combustion. The anomalies inherent in some of the existing models and approaches to improve both qualitative and quantitative predictive capabilities are discussed. Modelling alkane combustion chemistry over extended ranges of equivalence ratio, pressure, and temperature, requires the consideration of sequential but partially overlapping processes: an initial period of induction phase chemistry; conversion of primary aliphatics to olefins, oxidation of the resulting oelfins to carbon monoxide, and simultaneous oxidation of hydrogen produced in the hydrocarbon destruction. The conditions under which the induction phase chemistry can be neglected in modelling efforts is explored. HO2 chemistry is found to be required in order to extend the applicability of detailed hydrogen/carbon monoxide/oxygen mechanisms to ranges of pressure and temperature normally used in practical combustion system modelling. Functional quasi-global kinetic expressions for alkane oxidation are discussed and errors in some published results on overall rate coefficients are clarified. Stress is given to the advantages of quasi-global kinetic modelling and the additional modifications required for these models to have greater applicability.

12437 **(AD-A—132161/1) Combustion of hydrocarbons in an adiabatic flow reactor: some considerations and overall correlations of reaction rate.** Glassman, I.; Dryer, F.L.; Cohen, R. (Princeton Univ., NJ (USA). Dept. of Aerospace and Mechanical Sciences). Apr 1975. 40p. NTIS, PC A03/MF A01.

The applicability of kinetic measurements obtained in induction (ignition) phase measurements such as those made in shock tube and those obtained in the post induction phase by flow reactors has been clearly delineated - particularly with reference to hdyrocarbon oxidation. The usefulness and limitation of global kinetic modelling has also been carefully analyzed. Experimental results show that there appears to be three stages in the paraffin hydrocarbon oxidation process that must be considered if there is to be global modelling. The new element is a well defined initial step most easily recognizable in the temperature range of the flow reactor. This step is the relatively isoenergetic conversion of the paraffin to the olefin. Extensive work with ethane indicates that the conversion rete is proportinoal to the amount of ethane converted. Future work will attempt to explain this functional dependence of this phase of the overall paraffin hydrocarbon oxidation process.

12438 **(AD-A—132234/6) N(2) and CO vibrational CARS and H(2) rotational CARS spectroscopy of CH(4)-N(2)O flames. Final report.** Aron, K.; Harris, L.E.; Fendell, J. (Army Armament Research and Development Command, Dover, NJ (USA). Large Caliber Weapon Systems Lab.). Aug 1983. 36p. NTIS, PC A03/MF A01.

Broadband CARS (coherent anti-Stokes Raman scattering) spectra of N(2) and C0 were obtained from the post-flame gases of rich CH(4)-N(2)O flames by the use of the nonplanar BOXCARS technique. The temperature and concentration of both N(2) and CO in these flames, estimated from CARS spectra with the aid of model calculations, agreed with standard thermochemical predictions. In addition, several pure rotational H(2) CARS transitions, most of which had previously been unobserved, were seen in several spectral regions, most notably in both the CO and NO CARS regions. These observations are important in future modeling of CARS data.

12439 **(DOE/ER/14953—4) Studies of combustion kinetics and mechanisms. Progress report, January 1, 1983-December 31, 1983.** Gutman, D. (Illinois Inst. of Tech., Chicago (USA). Dept. of Chemistry). 1 Jan 1984. Contract AC02-78ER14953. 24p. NTIS, PC A02/MF A01. Order Number DE84005806.

The objective of the current research is to gain new quantitative knowledge of the kinetics and mechanisms of the reactions of polyatomic free radicals that are important in hydrocarbon combustion processes. The major research activities involve studies of the kinetics and mechanisms of the reactions of hydrocarbon free radicals with molecular oxygen up to 1000 K.

42 ENGINEERING

REFER ALSO TO CITATION(S) 13082

4201 General Engineering

12440 **(DOE/ER/10693—T1) Lubrication of engineering surfaces - II. Final report.** McCool, J.I. (SKF Industries, Inc., King of Prussia, PA (USA)). Dec 1983. Contract AC02-80ER10693. 183p. NTIS MF A01. Order Number DE84005685.

Microfiche only, copy does not permit paper copy reproduction.

The focus of the work was to improve the state-of-the-art of performance prediction for rolling/sliding contacts in terms of the statistical microgeometry of the contacting bodies and the properties of the fluid medium that separates the surfaces. The work was divided into several interrelated areas: development of an asperity contact model that accounts for the inherent directionality (anisotropy) that typifies real surfaces and that specifically reflects the effect of frequency content of the roughness process; development of guidelines for preprocessing (filtering) roughness data and for assessing the distortional effect of stylus radius and flight, record length, sampling rate and quantization error on the generalized surface characterization required by the contact model; delineate the limitations of the assumptions of mechanical and statistical independence and gaussianity, inherent in asperity contact models and the limitations of modelling asperity shapes as 2nd order polynomials; development and experimental validation of a combined

fluid/coulomb model for predicting the traction transmitted when real surfaces undergo relative rolling and sliding in the important regime where the lubricant film is thin enough to permit some degree of asperity contact; and generation and compilation of lubricant and surface roughness data required for contact performance prediction and quantification of the statistical error inherent in surface characterizations.

12441 **(FRNC-TH—1135) Contribution of apparently non-operating loadings to the buckling of thin shells and plates.** Delaigue, D. (Ecole Nationale des Ponts et Chaussees (ENPC), 75 - Paris (France)). Feb 1980. 143p. (In French). NTIS (US Sales Only), PC A07/MF A01. Order Number DE83704233.

This work includes four parts: in the first part, the Kirchhoff-Love theory of thin shells is described, a theory taken up and developed by Koiter and whose modelling seems to meet the problems of engineers. The second part deals with the buckling of a thin plate subjected to a load along a part of its edge, of which a part or all is seemingly inoperative. In the third part the study is extended to shells of any shape subjected to a conservative loading of the "dead-loading" type along part of their edges. On the basis of the results of the previous study, a study is then made on the taking into account of any load applied to the edge of a thin shell. In the fourth part the previous results are applied to the study of the buckling of a thin shell with a circular base subjected along a part of its edge to a normal prestress and to twisting moments linear density.

12442 **(UCID—19950) Frequency domain approach to structural analysis.** Weaver, H.J. (Lawrence Livermore National Lab., CA (USA)). 1 Mar 1983. Contract W-7405-ENG-48. 46p. NTIS, PC A03/MF A01. Order Number DE84005110.

To conduct a forced vibration analysis, a mathematical model of the structure is first constructed. In this case, a single degree of freedom model (SDOF) is assumed. Solution of the model in the time domain using the impulse response and the fast Fourier transform methods are briefly described prior to introducing the frequency domain approach. The solution in the frequency domain, involving the eigenfunctions and transfer functions of the system, is then performed. The relationship between the time and frequency domain solutions is discussed, and the transfer function of a general structure is derived. The models can be analyzed in terms of displacement, velocity, or acceleration. Using the Fourier transform method, the response spectrum of a structural system may be determined. (LEW)

12443 **(UCRL—52000-83-11) Energy and technology review.** (Lawrence Livermore National Lab., CA (USA)). Nov 1983. Contract W-7405-ENG-48. 38p. NTIS, PC A03/MF A01. Order Number DE84003925.

Separate abstracts were prepared for three papers in this review. (LEW)

12444 (UCRL—52000-83-11, pp 1-8) **Compliant surface coatings to reduce turbulent drag and noise.** Nov 1983. NTIS, PC A03/MF A01.

In Energy and technology review.

Investigations, through theoretical analysis and computer simulations, of hull coatings that can improve a vessel's performance by reducing the turbulence and associated noise and drag generated by the movement of the vessel through the water are described. (GHT)

12445 **Method and apparatus for controlling electrode gap during vacuum consumable arc remelting.** Fisher, R.W.; Maroone, J.P.; Tipping, D.W.; Zanner, F.J. US Patent Application 6-453,977. [nd]. 23p. Contract AC04-76DP00789.

During vacuum consumable arc remelting the electrode gap between a consumable electrode and a pool of molten metal is difficult to control. The present invention monitors drop shorts by detecting a decrease in the voltage between the consumable electrode and molten pool. The drop shorts and their associated voltage reductions occur as repetitive pulses which are closely correlated to the electrode gap. Thus, the method and apparatus of the present invention controls electrode gap based upon drop shorts detected from the monitored anode-cathode voltage. The number of drop shorts are accumulated, and each time the number of drop shorts reach a predetermined number, the average period between drop shorts is calculated from this predetermined number and the time in which this number is accumulated. This average drop short period is used in a drop short period electrode gap model which determines the actual electrode gap from the drop short. The actual electrode gap is then compared with a desired electrode gap which is selected to produce optimum operating conditions and the velocity of the consumable error is varied based upon the gap error. The consumable electrode is driven according to any prior art system at this velocity. In the preferred embodiment, a microprocessor system is utilized to perform the necessary calculations and further to monitor the duration of each drop short. If any drop short exceeds a preset duration period, the consumable electrode is rapidly retracted a predetermined distance to prevent bonding of the consumable electrode to the molten remelt.

4202 Facilities And Equipment

REFER ALSO TO CITATION(S) 11573, 11599, 11863, 11864, 11963, 11965, 12356, 12680, 13016

12446 **(AD-A—130872/5) Survivability tests on a nuclear waste cask in simulated railroad accident fires. Final report.** Wright, W.P.; Zook, J.A.; Jackson, W.F. (Army Armament Research and Development Command, Aberdeen Proving Ground, MD (USA). Ballistics Research Lab.). Jun 1983. 154p. (ARBRL-MR—03284). NTIS, PC A08/MF A01.

A test program was executed to determine the survivability of a nuclear waste cask when exposed to a fire due to a train derailment. The particular cask in question was modified to be similar to those which are used for transporting nuclear waste by rail. The modification consisted of adding impact limiters on each end to absorb shock in the event of an accident and a jacket filled with water to serve as a neutron shield. A total of five tests was conducted using a propane torch as the heat source with the center of the torch positioned at different locations on the cask. The torch nozzle was positioned 12 feet from the surface of the cask in the first four tests which constituted a torch fire situation and 20 feet in the fifth test to simulate a pool fire situation. The report presents a description of the nuclear waste cask, the test procedures used in the program, the test data, and some general observations on the test series.

12447 **(AD-A—130913/7) Transient response of superconducting microbridges to supercritical currents. Interim report.** Frank, D.J. (Harvard Univ., Cambridge, MA (USA). Div. of Applied Sciences). Jun 1983. 165p. (TR—20). NTIS, PC A08/MF A01.

We have made time-resolved measurements of the voltage waveforms on one-dimensional superconducting strips caused by current pulses in excess of their critical currents. We report the first known observations of the kinetic inductance spike the non-zero minimum voltage, and the time-domain development of phase-slip centers. These measurements were made on indium microbridges and represent an important extension of the work of Pals and Wolter to a higher critical temperature material. We have also measured the delay time between the application of the current pulse and the development of the first phase slip center in these bridges and have used it in conjunction with the SST theory (Schmidt, Schon and Tinkham 1980) to estimate a Tau sub E of 140 picoseconds for indium. In addition we have made a few measurements on dirty aluminum strips which also show the time domain development of phase slip centers. We have compare the data with the nonequilibrium superconductivity theory SST wherever possible. To do this, we have developed a computer program that approximation. From these numerical solutions we have found that, for the most part, the theory is in good agreement with the data. We have also used this exact solution to test the validity of several simpler approximations.

12448 **(AD-A—130914/5) Phase-slip centers and their interactions. Interim report.** Aponte, J.M. (Harvard Univ., Cambridge, MA (USA). Div. of Applied Sciences). Jun 1983. 123p. (TR—21). NTIS, PC A06/MF A01.

The author performed a series of different experiments in order to measure the diffusion length of the quasiparticle charge generated in a phase-slip center (PSC) and to detect the oscillations of the supercurrent in the PSC. Three different types of samples were fabricated photolithographically: samples of type S, samples of type T and samples of type M.

12449 **(AD-A—131024/2) Para: a computer simulation code for plasma driven electromagnetic launchers.** Thio, Y.-C. (Materials Research Labs., Maribyrnong (Australia)). Mar 1983. 33p. (MRL-R—873). NTIS, PC A03/MF A01.

A computer code for simulation of rail-type accelerators utilizing a plasma armature has been developed and is described in detail. Some time varying properties of the plasma are taken into account in this code thus allowing the development of a dynamical model of the behavior of a plasma in a rail-type electromagnetic launcher. The code is being successfully used to predict and analyse experiments on small calibre rail-gun launchers.

12450 **(AD-A—131167/9) Investigation of wave rotor turbofans for cruise missile engines. Volume 1. Final report.** Taussig, R.; Cassady, P.; Zumdieck, J.; Thayer, W.; Klosterman, E. (Mathematical Sciences Northwest, Inc., Bellevue, WA (USA)). Apr 1983. 135p. NTIS, PC A07/MF A01.

Wave rotors have been investigated as a technology for improving the performance of small turbofan engines in the 600 to 1000 lb. thrust class. This report summarizes the results of an eight-month study to analyze wave rotor performance for different configurations and to determine its sensitivity to operating and design parameters. Engine cycle calculations were also performed in order to estimate engine performance improvements and sensitivity to the wave rotor component. Wave rotor/turbines and pressure exchanger wave rotors both have been evaluated. In each case, experimental data exists which confirms predicted wave rotor performance over a wide range of operating conditions.

12451 **(AD-A—131991/2) Effectiveness of the mark v chemical-biological mask worn over spectacles. Interim report.** Luria, S.M.; Dougherty, J.H. Jr. (Naval Submarine Medical Center, Groton, CT (USA). Submarine Medical Research Lab.). 6 Jul 1983. 49p. (NSMRL—1006). NTIS, PC A03/MF A01.

Leakage into the Mark V Chemical-Biological Mask was measured when it was worn over four different eyeglass frames, the Standard S-10 Navy issue, the Sampson P-3 gold wire and P-3 matte chrome frames, and the Army combat frame. Although there were great differences between frames, there was appreciable leakage with every frame.

12452 **(AD-A—134043/9) Closed cycle cryocooler for low temperature electronics circuits: cold end test. Final report, 9 April-31 December 1982.** Pirtle, F.W. (CTI-Cryogenics, Inc., Waltham, MA (USA)). Aug 1983. 27p. NTIS, PC A03/MF A01.

A fabricated MACOR cold end including a metallic coating to prevent helium permeation and a fabricated die post displacer support bearing were combined with a compressor and motor which are standard CTI-CRYOGENICS products. A mechanical test was performed on the test cryocooler to determine that the mechanical test was performed on the test cryocooler to determine that the MACOR displacer was successfully guided by the die post bearing. Thermodynamic tests were conducted to determine the lowest temperature of the 4th (coldest) stage as a function of operating speed, helium charge pressure, 4th stage electrical heat load, and transfer tube diameter. Cooldown and steady state results are reported. Results indicate a low temperature limit of approximately 95K with the current test hardware. Although this represents an improvement from 122K during the program, a resizing will be necessary to reach 10K. The die post displacer support bearing and the MACOR cold finger construction are mechanically satisfactory.

12453 **(AD-P—001709/5) High velocity penetration into fibre-reinforced concrete materials - protection of buildings.** Anderson, W.F.; Watson, A.J.; Armstrong, P.J. (Sheffield Univ. (England). Dept. of Civil and Structural Engineering). May 1983. 6p. NTIS, PC A02/MF A01.

Fibre reinforced concrete suitable for spraying onto existing structures is being examined to assess its resistance to penetration by 7.62mm diameter armour piercing projectiles. A major test programme is being carried out to examine the influence of aggregate type and fibre type. For each aggregate/fibre combination a statistical method is being used to plan test series which will lead to optimization of the concrete in terms of water/cement ratio, fibre content and aggregate/cement ratio. The minimum thickness of optimized concretes to resist penetration by the projectile and minimise spall and scabbing, will be determined. The mechanics of the impact and penetration event are being studied and a possible method of deflecting the projectile within the concrete is suggested.

12454 **(AD-P—001737/6) Swedish design manual for protective structures.** Vretblad, B.E.; Svedbjoerk, G.B. (Kungliga Fortifikationsfoevaltningen, Eskilstuna (Sweden)). May 1983. 2p. NTIS, PC A02/MF A01.

The design of Swedish military hardened concrete structures is based on different manuals among those RSFA publ NBk 25. This publication gives design values for three different classes of structures A-C where e g different degrees of deformations are accepted. The paper describes the design procedures, according to the manual, with respect to fragment penetration.

12455 **(AD-P—001749/1) Has a decade made a difference.** Haltiwanger, J.D. (Illinois Univ., Urbana (USA)). May 1983. 4p. NTIS, PC A02/MF A01.

The design of structures to resist conventional weapons' effects is significantly more complex than is the design of structures to withstand the effects of nuclear weapons. In the case of nuclear weapons' effects, there are, really, only three problems that face the designer of a protective structure. These problems can be identified, in general terms, as follows: Define the free-field, blast-induced environment in which the structure will exist; Define the time-dependent and spatially distributed forces and motions that are imposed by this environment on the structure, and Compute the response of the structure to these blast-imposed excitations.

12456 **(BMFT-FB-T—83-216) Tests to increase the life of hydraulic pit props by means of new coatings.** Seebacher, G.; Ehrhardt, J. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Oct 1983. 59p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84750521.

State: The project has been terminated with a small-scale field test. The transfer to technical size has still to be made. Object: The object was a coating procedure which combines the advantages of a hard surface with those of a ductile matrix in order to increase the life of pit props. Method: The requirements on the new coating have been ascertained from an analysis of damages. Test specimens with four dispersion-hardened coatings as well as hard chromium (for comparison) have been submitted in the laboratory to climatic, bending and abrasion strain. That coating showing the best results has been field tested. Result: The coating which proved to be the relatively best one was an electro-deposited nickel matrix with Al_2O_3 inclusions. Conclusion: Hydraulic props subject to corrosion and mechanical stress with Ni-Al_2O_3 coating can reach an increased life.

12457 **(DOE/ER/52069—T1) Development of low-cost multifilamentary Nb_3Sn superconductor. Final report.** Schwall, R.E.; Hemachalam, K.; Hazelton, D.W.; Royet, J.M.; Ozeryansky, G.M. (Intermagnetics General Corp., Guilderland, NY (USA)). Oct 1981. Contract AC01-80ER52069. 50p. NTIS, PC A03/MF A01. Order Number DE84002237.

Portions are illegible in microfiche products.

The work reported here was intended to be the first of three phases of a development program leading to the fabrication of a low cost multifilament Nb_3Sn conductor. The decision not to

pursue Phases 2 and 3 was made approximately eleven months into Phase 1, so the work reported here contains the numerous loose ends characteristic of a suddenly truncated program. In this section we will critically review each of the three conductor concepts, and then indicate the practical utility of the conductor at its present state of development and its potential for other uses.

12458 **(HEDL-SA—3018FP) Effect of preload upon the strength of typical concrete expansion anchors under dynamic loading.** Lindquist, M.R. (Hanford Engineering Development Lab., Richland, WA (USA)). 1984. Contract AC06-76FF02170. 19p. (CONF-840368—1). NTIS, PC A02/MF A01. Order Number DE84004950.

From American Concrete Institute annual conference; Phoenix, AZ, USA (1 Mar 1984).

This paper describes the results of an industry survey of concrete anchorage test data and subsequent exploratory testing in an area where additional data were desired. The survey findings indicated that the majority of testing has been in static tension on wedge, sleeve, and shell expansion anchor configurations. Accordingly, additional testing specifically addressing the effects of anchor preload and dynamic loading was desirable. A series of tests were then accomplished which evaluated the effects of preload upon the strength of concrete anchorages under low cycle dynamic loading. Typical concrete installations of wedge and shell expansion anchors were tested, with loading of the anchors in direct tension, direct shear, and combined tension and shear. The dynamic loads were applied at a frequency of five hertz, in increasing load steps, until failure occurred. A minimum load level was chosen such that some load reversal occurred, thus causing impacting such as might occur under seismsic loading conditions. It was concluded that, providing the installation torque is properly applied, an expansion anchor will carry low cycle dynamic loads and provide adequate stiffness even though up to one half of the anchor preload is lost.

12459 **(JINR—8-82-172) High-voltage heavy-current leads into liquid-helium cryostats.** Anishchenko, N.G.; Volkov, V.Ya.; Khaller, R.; Tsvineva, G.P.; Shishov, Yu.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1982. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704333.

Some properties of electroinsulating designs of high-voltage cryoelectric equipment are considered. The results are discussed of investigating surface dielectric strength under cryogenic conditions of models of bushing insulators made of monolithic teflon. New designs of heavy-current leads into liquid helium cryostats based on the obtained results are suggested and built. The results of testing these current leads at 80 and 100 kV voltage and a 5.5 kA current are presented.

12460 **(NUREG/CR—3545) Comparison of energy measurements in the standard penetration test using the cathead and rope method. Phases I and II. Final report.** Kovacs, W.D.; Salomone, L.A.; Yokel, F.Y. (National Bureau of Standards, Washington, DC (USA)). Nov 1983. 94p. NTIS, PC A05/MF A01 - GPO $4.50. Order Number DE84900701.

Studies conducted on the Standard Penetration Test (SPT) and its present use in engineering practice show that a wide variation in the use of different pieces of SPT equipment, procedures and personnel results in a range of energy measured in the drill rods from 30 to 85 percent of the standard SPT energy. The potential energy and kinetic energy of the hammer were measured prior to impact, and the energy passing through the drill rods was calculated from a force-time measurement in the rods. It was found that safety (type) hammers tend to allow more kinetic energy to pass through the hammer-anvil system than donut (type) hammers. The energy passing through the drill rods was calculated by using a digital processing oscilloscope and an SPT Calibrator. Lessons learned in evaluating the energy measurement by these two methods are discussed. The combined effect of the drill rig used, the operator and his procedures, and the SPT equipment should be considered when energy is to be evaluated. The variation of average energy ratio within various drill rig models was found to be about as large as that among drill rig models. It was therefore impossible to make a statistically significant estimate of the reference energy which is representative of the average energy delivered in the US practice. 29 references, 24 figures, 20 tables.

12461 **(PB—83-254698) Catalogue of facilities in Member States of the European Communities for testing the packaging of radioactive materials.** Marchal, A.; Swindell, G.E. (Commission of the European Communities, Luxembourg). [nd]. 102p. NTIS, PC E06/MF E06.

On the recommendation of a group of experts, convened by the Commission of the European Communities in Brussels on 2nd July 1980 to deal with the safe transport of radioactive materials, a letter of enquiry was sent to the competent authorities of the Member States. The purpose of the enquiry was to assist in the effective implementation of the internationally accepted Regulations for the Safe Transport of Radioactive Materials through the dissemination of information on test facilities and on the terms and conditions under which the services of these facilities could be made available for the testing of packaging designed in other countries. As an aid to the presentation of the material, a harmonised format was suggested for covering relevant topics. The information received by the Commission has been assembled for each installation according to this format. (Copyright (c) ECSC-EEC-EAEC, Brussels Luxembourg 1982.)

12462 **(PB—83-260844) Laboratory procedures for the choice and sizing of dewatering equipment in the mineral processing industry.** Pearse, M.J. (Warren Spring Lab., Stevenage (UK)). [nd]. 38p. NTIS, PC E04/MF E04.

It is common practice to size thickeners and filters from laboratory-scale tests and this report describes the procedures used. The report commences with the initial choice of dewatering most suited for a given slurry. Batch thickening test data are treated by the methods of Coe and Clevenger, Talmage and Fitch, and Oltmann. The filter leaf test is described in detail. In each case worked examples show how the calculations are made from the experimental data. Sampling procedures and the use of flocculants to promote gravity settling and filtration are described in appendices. (Copyright (c) Crown Copyright 1978.)

12463 **(PB—83-261404) Textile wastes and their reclamation: a survey of recent literature.** Veal, F.J. (Warren Spring Lab., Stevenage (UK)). [nd]. 16p. NTIS, PC E03/MF E03.

This report is a review of recent literature on the reclamation of fibrous textile wastes. Because of changes in the industry, notably the growing use of synthetics plus other technical and economic problems, increasing quantities of waste are being disposed of overseas or dumped as landfill. Unfortunately there is not enough information published to enable a proper assessment of the situation to be made. (Copyright (c) Crown Copyright 1980.)

12464 **(UCID—19989) LABAN emplacement pipe load-release test and stemming/canister alignment study.** Howard, D.L. (Lawrence Livermore National Lab., CA (USA)). 2 Dec 1983. Contract W-7405-ENG-48. 50p. NTIS, PC A03/MF A01. Order Number DE84006227.

An Emplacement Pipe Load-Release Test and a study of downhole alignment during stemming were performed on the LABAN event. The purpose of these experiments was to determine canister and line of sight (LOS) distortion induced by downhole stemming and load-release procedures. The load-release test was aborted at approximately 40% completion due to excessive canister distortions. This report summarizes test results in terms of emplacement pipe loads vs vertical canister motions, canister and LOS lateral displacements, and the changes in LOS alignment that resulted from the downhole stemming and load-release processes.

12465 **Design of radioactive material shipping packaging for low-velocity puncture resistance.** Nickell, R.E. (Electric Power Research Inst., Palo Alto, CA (USA)); May, R.A. (Sandia National Labs., Albuquerque, NM (USA)). *Nuclear Engineering and Design;* **74**: No. 2, 223-232(Feb 1983).

Both the standards developed by the International Atomic Energy Agency (IAEA) and those contained in the U.S. federal regulations stipulate that transport packagings containing large quantities of radioactive material, such as spent fuel from a nuclear

power reactor or waste by-products from nuclear weapons programs, should be designed to resist a sequence of impact, puncture, fire, and water immersion conditions without harmful release of contents. A recent paper has offered a perspective on the design of such packagings relative to the impact event - a 30 ft (9m) drop onto an essentially unyielding target. In this paper the second event in the accident design sequence is addressed - the 40 in (1 m) drop of the packaging, after primary impact, onto a mild steel cylindrical punch.

12466 **Conical O-ring seal.** Chalfant, G.G. Jr. US Patent Application 6-462,155. [nd]. 21p. Contract AC09-76SR00001.

A shipping container for radioactive or other hazardous materials has a conical-shaped closure containing grooves in the conical surface thereof and an O-ring seal incorporated in each of such grooves. The closure and seal provide a much stronger, tighter and compact containment than with a conventional flanged joint.

12467 **Locking apparatus for gate valves.** Fabyan, J.; Williams, C.W. US Patent Application 453,981. [nd]. 24p. Contract W-7405-ENG-48.

A locking apparatus for fluid operated valves having a piston connected to the valve actuator which moves in response to applied pressure within a cylinder housing having a cylinder head, a catch block is secured to the piston, and the cylinder head incorporates a catch pin. Pressure applied to the cylinder to open the valve moves the piston adjacent to the cylinder head where the catch pin automatically engages the catch block preventing further movement of the piston or premature closure of the valve. Application of pressure to the cylinder to close the valve, retracts the catch pin, allowing the valve to close. Included are one or more selector valves, for selecting pressure application to other apparatus depending on the gate valve position, open or closed, protecting such apparatus from damage due to premature closing caused by pressure loss or operational error.

12468 **Method and apparatus for molecular imaging using x-rays at resonance wavelengths.** Chapline, G.F. Jr. US Patent Application 6-445,596. [nd]. 30p. Contract W-7405-ENG-48.

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Holographic x-ray images are produced representing the molecular structure of a microscopic object, such as a living cell, by directing a beam of coherent x-rays upon the object to produce scattering of the x-rays by the object, producing interference on a recording medium between the scattered x-rays from the object and unscattered coherent x-rays and thereby producing holograms on the recording surface, and establishing the wavelength of the coherent x-rays to correspond with a molecular resonance of a constituent of such object and thereby greatly improving the contrast, sensitivity and resolution of the holograms as representations of molecular structures involving such constituent. For example, the coherent x-rays may be adjusted to the molecular resonant absorption line of nitrogen at about 401.3 eV to produce holographic images featuring molecular structures involving nitrogen.

12469 **Coherent multilayer crystals and method of making.** Schuller, I.K.; Falco, C.M. US Patent Application 6-441,900. [nd]. 20p. Contract W-31-109-ENG-38.

A new material consisting of a multilayer crystalline structure is described which is coherent perpendicular to the layers and where each layer is composed of a single crystallilne element. The individual layers may vary from 2A to 100A or more in thickness.

4203 Lasers

REFER ALSO TO CITATION(S) 12586, 12673

12470 **(AD-A—130988/9) Fundamental study of nuclear pumped laser plasmas. Special report.** Downes, L.W.; Marcum, S.D.; Tilton, R.A.; Wells, W.E. (Miami Univ., Oxford, OH (USA). Dept. of Physics). 23 Dec 1980. 39p. NTIS, PC A03/MF A01.

Although there have been many activities during the preceding report periods, this interim report will restrict itself to the theoretical prediction of a new laser amplifier process and experimental evidence for the existence of the process. This special report is being generated because this new laser processor may have significant impact on nuclear pumped lasers, as well as high power (and high energy) laser systems in general.

12471 **(AD-A—131646/2) Bibliography of soviet laser developments, Number 59, May - June 1982.** (Defense Intelligence Agency, Washington, DC (USA). Directorate for Scientific and Technical Intelligence). 1 Jun 1983. 138p. (DIA-DST—2700z-005-83). NTIS, PC A07/MF A01.

This is the Soviet Laser Bibliography for May-June 1982, and is No. 59 in a continuing series on Soviet laser developments. The coverage includes basic research on solid state, liquid, gas, and chemical lasers; components; nonlinear optics; spectroscopy of laser materials; ultrashort pulse generation; theoretical aspects of advanced lasers; and general laser theory. Laser applications are listed under biological effects; communications; beam propagation; computer technology; holography; laser-induced chemical reactions; measurement of laser parameters; laser measurement applications; laser-excited optical effects; laser spectroscopy; beam-target interaction; and plasma generation and diagnostics.

12472 **(AD-A—131691/8) Time dependent pulse amplification in a three level gas. Progress report, 1 January-31 December 1980.** Morse, T.F.; Tsai, T. (Brown Univ., Providence, RI (USA). Dept. of Engineering). Dec 1980. 47p. NTIS, PC A03/MF A01.

The time dependent density matrix equations have been solved in conjunction with the field amplitude equations for a three level optically pumped gas. The solutions are valid in the limit in which the pumping pulse is longer than the dephasing time of the system and true coherent effects may be neglected. It is assumed that the FIR field is smaller than the pump field, and saturation effects associated with this field are absent. In the limit in which the pump pulse is resonant, particularly simple results for the FIR field amplification may be obtained. The solutions exhibit the dependence of the FIR output pulse on the shape of the input pulse. Further, as a consequence of non-linear saturation effects on the pump pulse transition, the FIR pulse is initially created with two peaks, one associated with the leading edge and one with the trailing edge of the pump pulse. As amplification on the FIR transition and pump absorption increase, these two peaks merge.

12473 **(AD-A—131837/7) Studies of collisional and nonlinear radiative processes for development of coherent uv and xuv sources. Final report, 1 October 1981-30 November 1982.** Rhodes, C.K.; Pummer, H.; Egger, H. (Illinois Univ., Chicago (USA). Dept. of Physics). Sep 1982. 69p. NTIS, PC A04/MF A01.

High spectral brightness rare gas halogen (RGH) sources can be used to generate coherent extreme ultraviolet radiation by either harmonic generation mechanisms or direct multiquantum excitation of appropriate gain media. In order to demonstrate the basic characteristics of these two approaches, recent comparative measurements have been made. With the use of a 4 GW 193 nm (ArF^*) system operating at a pulse duration of 10 ps, harmonic generation has been studied in several atomic and molecular media and used to generate 20 kW at 64.3 nm and 200 W at 38.6 nm. In addition, stimulated emission in molecular hydrogen on both the Lyman and Werner bands excited by two quantum absorption at 193 nm, has resulted in the generation of radiation as short as 117.6 nm at an efficiency of conversion approaching one percent. It has been concluded that the latter method is superior for the generation of short wavelength radiation. Extension of these results to both shorter wavelengths and higher power levels requires the ultraviolet. Recent studies of collision-free multiply-charged ion production with irradiation at 193 nm point to an anomalously strong coupling to high Z materials with processes involving as many as 99 quanta being observed. These multiquantum processes in the 40 - 80 eV range in certain atomic systems can be generated with existing laser instrumentation.

12474 **(AD-A—131860/9) Semiconductors investigated by time resolved Raman absorption and photoluminescence spectroscopy using femtosecond and picosecond laser techniques. Final report, 1 December 1979-30 November 1982.** Alfano, R.R.; Doukas, A.G. (City Coll., New York (USA). Dept. of Physics). 5 May 1983. 71p. NTIS, PC A04/MF A01.

This report summarizes the research progress achieved in the period 1979-1982 in the research effort supported by AFOSR 80-0079. Two main areas of research are: picosecond and subpicosecond laser development and application and time-resolved studies of semiconductors. In the subpicosecond laser development program we investigated a variety of cavities of different physical parameters. A stable and reliable oscillator, which produces 200 fsec pulses, has been developed using a ring configuration. The first generation amplifier system has been completed with a gain of 10 to the sixth power. We have produce continuum by focusing the amplified pulses in a CC14 cell; and have invented a femtosecond luminescence technique (called population mixing) for probing semiconductor processes.

12475 **(AD-A—131887/2) Wave optics investigations of transverse mode formation. Technical report.** Jones, R.W.; Perkins, J.F.; Shih, C.C. (Army Missile Command, Redstone Arsenal, AL (USA). Directed Energy Directorate). Mar 1982. 284p. NTIS, PC A13/MF A01.

Since the earliest days of laser operation, attention has been given to the properties of transverse modes of the radiation field within the laser, for both stable and unstable resonator configurations. One of the principal purposes of seeking good transverse mode properties is to obtain a well defined far field distribution with a large value of central intensity.

12476 **(AD-A—132352/6) Survey of electric laser codes. Technical report 1 Jul-30 Nov 80.** Wang, F.C. (Lockheed Missiles and Space Co., Huntsville, AL (USA)). Jun 1983. 120p. NTIS, PC A06/MF A01.

This report summarizes information gathered on a survey of available computer codes which can be used to analyze electric laser devices. The laser systems include carbon monoxide, carbon dioxide and excimers operating in either the CW or pulsed modes. Technical areas surveyed include kinetics, optics, and gas dynamics.

12477 **(AD-A—132374/0) Theoretical studies of oxygen-iodine laser mechanisms and new laser concepts. Final report.** Bellum, J.C. (New Mexico Univ., Albuquerque (USA)). Aug 1983. 20p. NTIS, PC A02/MF A01.

This report summarizes theoretical studies of molecular dynamics, of spin-forbidden molecular transitions, of gain-dependent dispersions in excimer lasers, and of path-integral approaches applied to descriptions of quantum optical phenomena. It also summarizes two other studies, one of injection locking of arrays of lasers and another of detuning effects in laser instabilities.

12478 **Pulse transformer mount for laser diodes.** Bender, G.M. US Patent Application 6-452,604. 23 Dec 1983. 10p.

A package for matching the characteristic impedance of a transmission line to the impedance of a pulsed semiconductor laser diode so that short duration pulses of light can be produced with a fast repetition rate. The package has toroidal transformer in a cavity of a main body, with a multiturn primary connected to a transmission line. The laser diode is mounted at the edge of a known sandwich between two thin metal plates separated by an insulating layer. A spacer and metal cover cap are placed over the sandwich, and screw passing through holes of all the parts is threaded into the main body. The screw passing through the transformer core forms a one-turn secondary. Not only does this allow the matching of the characteristic impedance, but also provides heat sinking for the diode. Assembly with a screw makes the unit easy to fabricate, and to replace the laser diode sandwich.

12479 **Push-pull pulsed gas laser.** Dezenberg, G.J.; Cooper, C.E. Jr. US Patent Application 6-525,374. 22 Aug 1983. 11p.

A push-pull pulsed gas laser which utilizes piston action to displace a laser gas from the laser cavity to a heat exchanger and return of the gas to the laser cavity between laser pulses to significantly reduce the volume of gas required for repetitively pulsed gas lasers and to reduce the average power required to recondition the laser gas.

12480 **CO_2 laser stabilization and switching.** Buholz, N.E. US Patent Application 6-504,353. 14 Jun 1983. 18p.

A C02 laser operating in the 10 micrometer band is stabilized by a stabilization circuit that compares the power in a selected pair of R and P lines. A switching circuit connected into the stabilization circuit causes the laser's operating point to be switched within a short interval wherein four different pairs of R/P lines can be output within about 100 ms.

12481 **Long-life triggered spark gap.** Elkins, J.N.; Friedman, S.; Turnquist, D. US Patent Application 6-502,420. 8 Jun 1983. 15p.

A discharge device for use with pulsed, CO_2 laser power conditioner systems, is disclosed. The device is comprised of Elkonite or molybdenum electrodes in a controlled nitrogen-xenon-oxygen environment, and having long life potential of close to twenty million discharges possible.

12482 **Device for cryogenically fabricating source material for plasma x-ray lasers.** Elton, R.C.; Dixon, R.H.; Ford, J.L. US Patent Application 6-500,725. 3 Jun 1983. 14p.

A device for fabricating a target of a lasing material and a pump material for lasing at X-ray wavelengths wherein one of the materials occurs naturally as a gas. A substrate of the other material is cooled below the freezing point of the one material occuring naturally as a gas. Then a gaseous atmosphere of the latter material is supplied to the cooled substrate so that a frozen layer of the latter material condenses onto the substrate to form the target.

12483 **Dual frequency optical cavity.** George, E.V.; Schipper, J.F. US Patent Application 6-477,456. [nd]. 17p. Contract W-7405-ENG-48.

Method and apparatus for generating two distinct laser frequencies in an optical cavity, using a T configuration laser cavity and means for intermittently increasing or decreasing the index of refraction n of an associated transmission medium in one arm of the optical cavity to enhance laser action in one arm or the second arm of the cavity.

12484 **Raman laser with controllable suppression of parasitics.** George, E.V. US Patent Application 6-473,178. [nd]. 12p. Contract W-7405-ENG-48.

Method and apparatus for switching energy out of a Raman laser optical cavity. Coherent radiation at both the pump and first Stokes wave frequencies are introduced into the optical cavity from the same direction, and a second Stokes wave is utilized to switch the energy out of the cavity.

12485 **Q-switched Raman laser system.** George, E.V. US Patent Application 6-455,445. [nd]. 12p. Contract W-7405-ENG-48.

Method and apparatus for use of a Raman or Brillouin switch together with a conventional laser and a saturable absorber that is rapidly bleached at a predeterimined frequency nu = nu/sub O/, to ultimately produce a Raman or Brillouin pulse at frequency nu = nu/sub O/ +- nu /sub Stokes/.

4204 Heat Transfer And Fluid Flow

REFER ALSO TO CITATION(S) 11844, 12675, 12688

12486 **(AD-A—131882/3) Laser velocimeter measurements and analysis in turbulent flows with combustion. Part 2. Interim report, 1 January-31 December 1982.** Stevenson, W.H.; Thompson, H.D.; Gould, R.D. (Purdue Univ., Lafayette, IN (USA). School of Mechanical Engineering). Jul 1983. 172p. NTIS, PC A08/MF A01.

Laser velocimeter measurements in the highly turbulent flow field following an axisymmetric sudden expansion have been carried out for both isothermal and reacting flows. Mean streamwise

velocity and turbulence intensity profiles covering the region from the sudden expansion to well beyond shear layer reattachment are presented. A study of velocity bias conducted as part of this investigation reconfirmed the effectiveness of the experimental bias elimination technique used in earlier studies. Numerical predictions of the isothermal flow field using the k-epsilon turbulence model were made and compared to experimental measurements. Significant differences in the mean velocity profiles were found to exist, with measured velocities in the central part of the flow being consistently higher than those predicted. Combustion was found to increase mean velocities in regions beyond the combustion zone as expected and to significantly alter the structure of the shear layer. Significant reductions in turbulence intensity were observed throughout most of the flow in the reacting flow case.

12487 **(AD-A—132141/3) Analysis of smooth and axially finned, rotating heat pipe condensers. Master's thesis.** Kleinholz, A.F. (Naval Postgraduate School, Monterey, CA (USA)). Jun 1983. 177p. NTIS, PC A09/MF A01.

A mathematical model is developed to determine the heat transfer rate of a cylindrical condenser section of a rotating heat pipe. This model is coupled to an existing code and an analysis is accomplished on both a smooth and axially finned condenser. The results of this analysis are compared to those of a similar analysis performed on a tapered condenser heat pipe using identical geometric and operating parameters. Results of the comparison indicate cylindrical condensers have a lower heat transfer rate than equivalent tapered condensers. This reduction in heat transfer rate is due to a greater condensate film thickness and is most significant in a smooth condenser. Axially finned condensers with triangular and rectangular fin profiles are also compared. The rectangular fins are assumed to have adiabatic tips. Results indicate the heat transfer rates for these two profiles vary by only 0.40 per cent for both tapered and cylindrical condenser.

12488 **(AD-A—132175/1) Effect of condensate inundation on steam condensation heat transfer to wire-wrapped tubing. Master's thesis.** Kanakis, G.D. (Naval Postgraduate School, Monterey, CA (USA)). Jun 1983. 161p. NTIS, PC A08/MF A01.

Steam condensation heat transfer measurements were made in a 5-tube test condenser having an additional perforated tube to simulate up to 30 active tubes. Results were obtained for smooth tubes and roped tubes wrapped with wire. A Sieder-Tate equation was used to correlate the inside heat-transfer coefficient. For smooth tubes, a leading coefficient of 0.029 was found, while it was 0.061 for the roped tubes. The average condensing coefficient measured for 30 smooth tubes was 0.59 times the Nusselt coefficient calculated for the first tube. When the smooth tubes were wrapped with wire, this ratio increased up to 0.86. Further, roped tubes without wire experienced a ratio of 0.63, while roped tubes wrapped with wire resulted in a ratio of 0.86. These preliminary data show that wire-wrapped tubes may lead to a significant reduction in condenser surface area.

12489 **(AD-A—132245/2) Condensation heat transfer of steam on a single horizontal tube. Master's thesis.** Graber, K.A. (Naval Postgraduate School, Monterey, CA (USA)). Jun 1983. 83p. NTIS, PC A05/MF A01.

An experimental apparatus was designed, constructed and instrumented in an effort to systematically and carefully study the condensation heat-transfer coefficient on a single, horizontal tube. A smooth, thick-walled copper tube of length 133.5 mm, with an outside diameter of 15.9 mm and an inside diameter of 12.7 mm was instrumented with six wall thermocouples. The temperature rise across the test section was measured accurately using quartz crystal thermometers. The inside heat-transfer coefficient was determined using the Sieder-Tate correlation with leading coefficient of 0.029. Initial steam side data were taken at atmospheric pressure to test the data acquisition/reduction computer programs.

12490 **(AD-A—132553/9) Experimental evaluation of the thermal performance of a rotating heat pipe with internal axial fins. Master's thesis.** Gardner, G.H. III. (Naval Postgraduate School, Monterey, CA (USA)). Jun 1983. 67p. NTIS, PC A04/MF A01.

A rotating heat pipe was tested using two different copper condensers (a smooth cylinder and a cylinder with 22 straight axial fins) and water as the working fluid. The smooth condenser was tested at rotational speeds of 700, 1400 and 2800 RPM. The finned condenser was tested at 700 RPM. The heat transfer rate for each run was measured and plotted against the temperature difference between the internal vapor and the cooling water inlet. Representative condenser wall temperature profiles were plotted for each run. The primary objectives was to compare the heat transfer rates obtained. The finned condenser heat transfer rates were 30-40 percent greater than those of the smooth condenser. All data appeared to be influenced by the presence of noncondensable gases. Recommendations for improvements to the rotating heat pipe system are included.

12491 **(NP—4770076) Influence of non-linear transports and temperature-dependent material values on calculation of streaming and propagation in gases with great changes of temperature, pressure and velocity.** Hess, R. (Siegen Univ. (Gesamthochschule) (Germany, F.R.). Fachbereich 11 - Maschinentechnik 1). 2 Feb 1981. 157p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84770076.

Discussion of feasibilities, which the kinetic gas theory offers for the extension of the simple linear transport equations. These extensions refine the mathematical model, which describes non-balance events. Examples are used to examine the contribution made by these model-refinements to a better description of non-balance-events. In order to evaluate the results of these tests, it is necessary to determine the influence of the mass-laws on the thermodynamic variables first. Both influences - oversimplified mathematical model and unprecise mass-values - may be overlapping, i.e. may be amplified or compensated. The investigation is limited on monatomic pure gases. Test-examples are: - the stationary one dimensional compression impact, because all thermodynamical variables are changing within the impact front, - the stationary plane shear streaming, where velocity changes are predominant, and - the instationary propagation of temperature fronts as example for the propagation events in gases.

12492 **(NP—4770078) Determination of heat and mass transfer on a parallel streamed plane plate by means of a two-equation model serving to calculate turbulent parameters.** Tiemann, K. (Kaiserslautern Univ. (Germany, F.R.). Fachbereich Maschinenwesen). 18 Dec 1981. 139p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84770078.

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The applicability of the K, epsilon-model according to Spalding was proved for the case of streams close to the wall. The diffusion of pressure, which has an eminent influence if there are local anisotrop flows is therefore converted into a value usable for calculations. A good agreement with the experimental results of the plane convectively streamed plate could be obtained by simply diminishing the term of production for kinetic energy by the energy loss caused by pressure difference. This term appears in the K-equation and the epsilon-equation and disappears outside of the boundary layer near the wall. In addition to laminar considerations of similarity, relations of similarity were stated within the ratio for impulses, turbulent kinetic energy and turbulent dissipation. This model can also be applied to the combined exchange of impulse, heat and impulse. Compared to the mixed length model this relation is extremly simple, because no corrections functions for the vertical wall stream have to be applied. The plate moisted and streamed on both sides shows the highest efficiency with regard to evaporating-effect and low temperature of surface. In case of counterstream an essential increase of evaporation would be feasible, if the temperature difference in the longitudinal direction were reduced by a thermal conduction plate.

12493 **(NP—4770155) Mass- and heat transfer at water trickled finned tubes.** Vilser, L. (Stuttgart Univ. (Germany, F.R.). Fakultaet Energietechnik). 22 Nov 1982. 171p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84770155.

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At five finned tubes of different geometries measurements were made of the heat and mass transfer during spraying with water and simultaneous passing of an air stream. Mass flow, air temperature, air moisture and air velocity were varied. From the results of the measurements the overall heat flux, the heat flux removed by the spray film, the heat flux transfered to the air by convection, the amount of evaporated water, the heat transfer coefficient between tube wall and spray film, the heat transfer coefficient between spray film and air stream, the mass transfer coefficient and the pressure drop in the air stream were calculated. The results are presented in diagrams, the heat transfer coefficient between spray film and air and the mass transfer coefficient are described by formulae. The comparison of the heat flux densities at the five different tubes shows that for the combination of dry cooling and spraying of the finned tubes, tubes with a small inner tube diameter and small height of the fins are most suited. The assumption frequently made, that the heat transfer coefficient between a gas flow and a spray film may be described by the mathematical interrelationships valid for the gas flow at a stationary wall is true only to a very limited extent. The same is valid for the determination of the pressure loss at the gas side. With a theoretical model it was tried to evaluate the phenomena at the finned tube by means of calculation. Starting from an overall concept described in the introduction formulations for solutions of partial problems were elaborated and results are presented. Because of the necessary simplifications a correlation with the results of the measurements was only achieved in subdomains. Possible starting points for improving the mathematical model are qualitatively described.

12494 **(NUREG/CR—3615) Hydrodynamics of two phase flow through homogeneous and stratified porous layers.** Chu, W.; Lee, H.; Dhir, V.K.; Catton, I. (California Univ., Los Angeles (USA). School of Medicine). Jan 1984. 156p. NTIS, PC A08/MF A01 - GPO $5.50. Order Number DE84900655.

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An experimental investigation of two-phase flow through porous layers formed of nonheated glass particles has been made. The effect of particle size, particle size distribution, bed porosity and bed stratification on void fraction and pressure drop through particulate beds formed in a cylindrical and rectangular test section has been investigated. A model based on drift flux approach has been developed for the void fraction in homogeneous beds. Using the two phase friction pressure drop data, the relative permeabilities of the two phases have been concluded with void fraction. The void fraction and two-phase friction pressure gradient in beds composed of mixtures of spherical particles as well as sharps of different nominal sizes have also been examined. It is found that the models for single size particles are also applicable to mixtures of particles if a mean particle diameter for the mixture is defined. The observations in stratified beds indicate depletion or build up of voids at the interface between high and low permeability regions. Blocking of the flow into one of the layers of laterally stratified beds caused the pressures at different horizontal locations at the same bed height to be different from each other.

12495 **(SAND—83-8253) TOPAZ: a computer code for modeling heat transfer and fluid flow in arbitrary networks of pipes, flow branches, and vessels.** Winters, W.S. (Sandia National Labs., Livermore, CA (USA)). Jan 1984. Contract AC04-76DP00789. 54p. NTIS, PC A04/MF A01. Order Number DE84006275.

An overview of the computer code TOPAZ (Transient-One-Dimensional Pipe Flow Analyzer) is presented. TOPAZ models the flow of compressible and incompressible fluids through complex and arbitrary arrangements of pipes, valves, flow branches and vessels. Heat transfer to and from the fluid containment structures (i.e. vessel and pipe walls) can also be modeled. This document includes discussions of the fluid flow equations and containment heat conduction equations. The modeling philosophy, numerical integration technique, code architecture, and methods for generating the computational mesh are also discussed.

12496 **Development of high efficiency droplet heat exchangers.** SeKins, K.M.; Thayer, W.J. III. (Mathematical Sciences Northwest Inc.). *Energy Technology (Washington, D.C.);* **10**: 733-742(Jun 1983). (CONF-830213—). Contract AC06-81ER10918.

From 10. energy technology conference; Washington, DC, USA (28 Feb 1983).

Problems in conventional heat exchangers associated with the physical separation of the hot and cold fluid streams by a solid wall have been mitigated by direct contact heat transfer between two counterflowing media in a droplet heat exchanger. DHX, developed by Mathematical Northwest Inc., consists of a verticle column containing a shower of molten droplets falling downward through an upward directed gas stream. The general principles of a DHX are described in this paper. Various configurations to yield methods to provide uniform distribution of droplets in the flow field are given. Studies identify the ranges of several design parameters for high effectiveness. The feasibility of a DHX is supported by DHX performance modelling studies and by droplet generation experiments, which indicate that the device could be more reliable than current heat exchangers.

12497 **Study of heat and mass transfer in a vertical-tube evaporative cooler.** Perez, B.M.; Bird, W.A. (Oak Ridge National Laboratory, Oak Ridge, Tennessee). *American Society of Mechanical Engineers, [Paper];* **82-WA/HT-75**: 8(1982). (CONF-821101—). Contract W-7405-ENG-26.

From ASME winter annual meeting (Engineering applications of laser velocimetry/published in ASME Jr. Fluid Engineering); Phoenix, AZ, USA (14 Nov 1982).

Evaporative coolers are three-fluid heat exchangers used to reject heat to the environment. A mixture of air and recirculating water is used as the cooling medium. These coolers are considered viable routes for improving thermal efficiencies of power-generating and refrigeration cycles. In this paper, the heat and mass transfer processes taking place in a vertical-tube evaporative cooler are studied. A steady-state, one-dimensional model of cooler performance is formulated and is validated by experimental measurements, taken in a single-tube exchanger, of the controlling heat and mass transfer coefficients. These coefficients occur at the air-water interface. Heat fluxes and enhancement ratios for conditions of interest are measured and calculated, and the results are compared and discussed. The model is found to adequately predict heat exchanger performance.

12498 **Means and method for vapor generation.** Carlson, L.W. US Patent Application 6-453,980. [nd]. 20p. Contract W-31-109-ENG-38.

A liquid, in heat transfer contact with a surface heated to a temperature well above the vaporization temperature of the liquid, will undergo a multiphase (liquid-vapor) transformation from 0% vapor to 100% vapor. During this transition, the temperature driving force or heat flux and the coefficients of heat transfer across the fluid-solid interface, and the vapor percentage influence the type of heating of the fluid - starting as feedwater heating where no vapors are present, progressing to nucleate heating where vaporization begins and some vapors are present, and concluding with film heating where only vapors are present. Unstable heating between nucleate and film heating can occur, accompanied by possibly large and rapid temperature shifts in the structures. This invention provides for injecting into the region of potential unstable heating and proximate the heated surface superheated vapors in sufficient quantities operable to rapidly increase the vapor percentage of the multiphase mixture by perhaps 10 to 30% and thereby effectively shift the multiphase mixture beyond the unstable heating region and up to the stable film heating region.

4205 Materials Testing

REFER ALSO TO CITATION(S) 11904, 12456

12499 **(AD-A—130665/3) Scattering of waves by irregularities in periodic discrete lattice spaces. 2. Calculations. Interim report.** Pomphrey, N.; Montroll, E.W.; West, B.J. (La Jolla Inst., CA (USA). Center for the Study of Nonlinear Dynamics). 1983. 40p. (LJI-R—83-229). NTIS, PC A03/MF A01.

The general formalism for the exact scattering of a scalar wave from N scatterers on a discrete lattice is reviewed. The interpretation of the exact solution in terms of approximation techniques is given and the expression for the scattering cross sections is derived. The expressions necessary for the calculation of the lattice Greens function are discussed and a number of asymmetric scattering configurations are considered.

12500 **(AD-A—131762/7) Improving nde (non-destructive evaluation) capability through multiple inspection with application to gas turbine engine disks. Final report, February-August 1982.** Yang, J.N.; Donath, R.C. (Air Force Wright Aeronautical Labs., Wright-Patterson AFB, OH (USA)). Jun 1983. 96p. (AFWAL-TR—82-4111). NTIS, PC A05/MF A01.

Techniques are not capable of repeatedly producing correct indications when applied to flaws of the same length. As a result, the probability of detection (POD) for all cracks of a given length has been used to define the capability of a particular NDE system in a given environment. Thus the NDE reliability consists of two types of errors. For safety-critical components in airframe structures, Type I error is of major concern. According to the damage tolerant requirement, the inspection limit or the reset crack size should be the crack length associated with a 90% detection probability and 95% confidence level. On the other hand the main criterion used for analysis of the retirement-for-cause of gas turbine engine components is the minimization of the life cycle cost. The objectives of this report are to: (1) formulate and derive mathematically the resulting POD curve for multiple inspection systems; (2) investigate quantitatively the benefit and advantage of multiple inspection procedures; (3) establish the direction in which the NDE capability should be improved under certain mission requirements; (4) establish the strategy and sequence for multiple inspection procedures to reduce either Type I or Type II errors or both; (5) determine the POD curve for a disk from the POD curve of an NDE system; (6) determine the inspection reliability of engine disks; and (7) evaluate the benefit of multiple inspections for engine disks.

12501 **(DOE/ER/02029—T4) Acoustic emissions signature analysis. Final report, July 1, 1978-May 31, 1983.** Pardee, W.J.; Arora, A. (Rockwell International Corp., Thousand Oaks, CA (USA). Science Center). Nov 1983. Contract AC03-78ER02029. 17p. NTIS PC A02/MF A01. Order Number DE84003219.

A series of systems were studied in an effort to bridge the gap between model sources and practical ones. Measurements were made of acoustic emission from controlled fracture of glass. Results suggested a significant angular dependence. Effects of heterogeneities on acoustic wave velocities were studied in 4340 steel. Corrosion-were studied in 4340 steel. Corrosion-induced acoustic emission in Al alloys were used to test signature analysis methods. (DLC)

12502 **(EGG-M—22783) Development of holographic interferometry for welding arc analysis.** Key, J.F.; McIlwain, M.E.; Chan, J.W.; Reynolds, L.D.; Trolinger, J.D. (EG and G Idaho, Inc., Idaho Falls (USA); Spectron Development Labs., Inc., Costa Mesa, CA (USA)). 1983. Contract AC07-76ID01570. 6p. (CONF-831195—6). NTIS, PC A02/MF A01. Order Number DE84005454.

From International congress on applications of lasers and electro-optics; Los Angeles, CA, USA (14 Nov 1983).

Automation of arc welding requires a scientific understanding of the transport phenomena occurring during the joining process. To monitor these arc transport processes a unique holographic interferometric technique has been developed. This technique employs multi-pass reconstruction of the flow field coupled with novel schemes for reference hologram preparation. This technique has been successfully used under laboratory welding conditions. The results of these preliminary measurements are discussed.

12503 **(FRNC-TH—1138) X-ray radiography and tomography applied to material testing.** Rechapt, J. de. (Institut National Polytechnique, 38 - Grenoble (France)). Nov 1982. 158p. (In French). NTIS (US Sales Only), PC A08/MF A01. Order Number DE83704235.

X-ray radiography and tomography are compared to detect a defect in an object. These image acquisition processes are first modelled by a convolution system. For a fixed contrast defect and a given X ray dose, the process providing the best signal-to-noise ratio is given by calculation. Then a system for pattern recognition is given: for identifying a defect, the related signs from binary images are sorted according to their size. The improvement in the detection performance of the device, for an adapted filtration of the images obtained, is assessed. The whole of the preceding results is validated on images synthesized on a computer, selecting between tomography and radiography, the technique making it possible to ensure the detectability of a defect with a minimal dose of X photons.

12504 **Current topics in radiographic testing and radiation protection. Abstracts.** Berlin, Germany, F.R.; Deutsche Gesellschaft fuer Zerstoerungsfreie Pruefung e.V. (1982). 7p. (In German). (CONF-8210158—Absts.).

From 2. seminar on current topics in radiographic testing and radiation protection; Muelheim an der Ruhr, F.R. Germany (26 Oct 1982).

This booklet contains the summaries of papers presented at the 2nd seminar of the Deutsche Gesellschaft fuer zerstoerungsfreie Pruefung, held in Muelheim (Ruhr) in October 1982. The topics discussed include the contrasty of modern radiographic films, fault detection in welded joints, inspection of non-medical radiological units and equipment, and topical issues of the field of radiation protection. (RW).

12505 **Assembly for testing weldability of sheet metal.** David, S.A.; Woodhouse, J.J. US Patent Application 6-447,577. [nd]. 7p. Contract W-7405-ENG-26.

A test assembly for determining the weldability of sheet metal includes (1) a circular plate having an annular groove in one side thereof, a counterbore being formed in the outer wall of said groove and the surface portion of said base circumscribed by the inner wall of said groove being coplanar with the bottom of said counterbore, (2) a test disk of sheet metal the periphery of which is positioned in said counterbore and the outer surface of which is coplanar with said one side of said base, and (3) means for holding the periphery of said test disk against the bottom of said counterbore.

12506 **Fixture for holding testing transducer.** Wagner, T.A.; Engel, H.P. US Patent Application 6-443,986. [nd]. 12p. Contract AC12-76SN00052.

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A fixture for mounting an ultrasonic transducer against the end of a threaded bolt or stud to test the same for flaws. A base means threadedly secured to the side of the bolt has a rotating ring thereon. A post rising up from the ring (parallel to the axis of the workpiece) pivotally mounts a variable length cross arm, on the inner end of which is mounted the transducer. A spring means acts between the cross arm and the base to apply the testing transducer against the workpiece at a constant pressure. The device maintains constant for successive tests the radial and circumferential positions of the testing transducer and its contact pressure against the end of the workpiece.

4206 Safety Engineering

12507 **(SAND—83-0581) Climatic safety monitoring system operator's guide.** Goldsmith, S.Y.; Simpson, C.E. (Sandia National Labs., Albuquerque, NM (USA)). Oct 1983. Contract AC04-76DP00789. 50p. NTIS, PC A03/MF A01. Order Number DE84006098.

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The Climatic Safety Monitoring System provides automatic, continuous monitoring of environmental test equipment located in the high bay area of Building 860 at Sandia National Laboratories. This report describes the system and how to operate it.

4208 Electronic Circuits And Devices

REFER ALSO TO CITATION(S) 12095, 12667, 12670, 12686, 12969

12508 **(AD-A—130745/3) Electronic properties of semiconductor interfaces. Final technical report, December 1981-February 1983.** Flores, F.; Tejedor, C.; Guinea, F.; Sanchez-Dehesa, J. (Universidad Autonoma de Madrid (Spain). Dept. de Fisica del Estado Solido). Feb 1983. 102p. NTIS, PC A06/MF A01.

The objective was to analyze the electronic properties of different semiconductor interfaces. The Wannier function formalism has been applied to the GaAs-AlAs (111) and (100) heterojunctions and superlattices. Ionic relaxations, band discontinuities and interface states have been obtained. Abrupt Si-metal interfaces and Si-interlayer-metal junctions have been analyzed by means of a self-consistent tight-binding approach. The barrier height has been obtained by calculating the interface density of states and the neutral level of the junction. Our results show that the barrier height is mainly determined by the coupling between the semiconductor and the last layer just sitting on top of the same semiconductor.

12509 **(AD-A—131752/8) Pulsed power bibliography. Volume 1. Indices. Final report.** Bemesderfer, J.; Druce, R.L.; Frantz, B.; Guenther, A.H.; Kristiansen, M. (Air Force Weapons Lab., Kirtland AFB, NM (USA)). Aug 1983. 304p. (AFWL-TR—83-74-VOL-1). NTIS, PC A14/MF A01.

Pulsed power and high-voltage technologies are playing an ever increasing role in weapons' effects simulation, fusion power research, power distribution, materials processing and medical research. It is a rapidly expanding field of applied physics as evidenced by the growth in published literature. Three years ago, the Air Force Weapons Laboratory (AFWL) initiated a project to compile a computerized data base of pulsed power research papers. The data base is stored on our IBM System 2000. This AFWL Technical Report is the first release of the bibliography to date. It contains about 2,500 full bibliographic citations, original sources, availability, key words and abstract. There are three indices: Subject, Personal Author, and Corporate Author. There are 30 main subject headings, from Breakdown Studies to Switching. The indices are contained in Volume I.

12510 **(AD-A—131753/6) Pulsed power bibliography. Volume 2. Annotated bibliography. Final report.** Bemesderfer, J.; Druce, R.L.; Frantz, B.; Guenther, A.H.; Kristiansen, M. (Air Force Weapons Lab., Kirtland AFB, NM (USA)). Aug 1983. 273p. (AFWL-TR—83-74-VOL-2). NTIS, PC A12/MF A01.

Pulsed power and high-voltage technologies are playing an ever increasing role in weapons' effects simulation, fusion power research, power distribution, materials processing and medical research. It is a rapidly expanding field of applied physics as evidenced by the growth in published literature. Three years ago, the Air Force Weapons Laboratory (AFWL) initiated a project to compile a computerized data base of pulsed power research papers. The data base is stored on our IBM System 2000. This AFWL Technical Report is the first release of the bibliography to date. It contains about 2,500 full bibliographic citations, original sources, availability, key words and abstracts. There are three indices: Subject, Personal Author, and Corporate. There are 30 main subject headings, from Breakdown Studies to Switching. Volume II contains the citations. In addition to these entries, the data base contains about 7,500 additional titles. As these titles are added to the full bibliography, they will be published.

12511 **(AD-A—132366/6) Logistical supportability of power conditioners. Final report 10 Jan-15 Jul 83.** Lynch, E.M. (Science Applications, Inc., McLean, VA (USA)). Jul 1983. 32p. NTIS, PC A03/MF A01.

Programmed increases of power dependent systems, and advanced concepts for their broad-based employment indicate a vital need to resolve the Army's quantity/quality electrical power problems. In the event of a tactical emergency, sustained reliance on military generators may introduce serious logistical challenges. Replacement of power sources when losses occur may be difficult. Technical support to accomplish paralleling of alternate sources may be in short supply. Demands for precise power to operate critical items may necessitate establishing priorities for electrical usage. Transfer from commercial to military power may cause system failures, especially to high-tech computer based items. To increase operational flexibility and reduce wear and tear on military generators, the Army should be capable of utilizing any commercial source. However, they must be able to shift to military power sources with minimum interruption. Power conditioners are the key to resolving the quantity/quality dilemma. They provide a means to operate all military systems from any world-wide power source regardless of voltage, frequency or precision. They are capable of altering the source characteristics of voltage and frequency to match the input requirements of all military equipment.

12512 **(AD-A—132379/9) Chemical vapor deposition of oriented tungsten foils for thermionic cathodes. Final report, 1 October 1981-30 November 1982.** Yang, L. (GA Technologies, Inc., San Diego, CA (USA)). Jun 1983. 21p. NTIS, PC A02/MF A01.

Efforts under the present contract were devoted to the preparation of CVD tungsten emitters containing a variety of preferred crystallographic orientations. The work is divided into two phases. In Phase I, a CVD tungsten deposition apparatus was built and CVD tungsten samples of various preferred crystallographic orientations were prepared and characterized with respect to microstructures and nature and degree of preferred orientations. These samples were delivered to NRL for the evaluation of their electron emission properties. In Phase II, efforts were made to produce a high degree of preferred crystallographic orientations in thin CVD tungsten deposits (approx. 25 micron thickness) which are amenable to hole drilling by laser. Techniques for preparing CVD tungsten cathode structure were established and samples of oriented tungsten cathode structure were prepared for NRL evaluation.

12513 **(DOE/PC/30303—5) Effect of solid particles on the turbulent flow of a round gaseous jet. A mathematical and experimental study. Final technical report.** Elghobashi, S.; Rizk, M.A. (California Univ., Irvine (USA). Dept. of Mechanical Engineering). Dec 1983. Contract FG22-80PC30303. 78p. NTIS, PC A05/MF A01. Order Number DE84005830.

The effect of solid particles on the flow structure of an axisymmetric turbulent incompressible jet has been studied theoretically and experimentally. A two-equation turbulence model has been developed for predicting two-phase flows. The two equations describe the conservation of turbulence kinetic energy and dissipation rate of that energy for the carrier fluid in a two-phase flow. They have been derived rigorously from the momentum equations of the carrier fluid. Closure of the time-mean equations is achieved by modeling the turbulent correlations up to third order. The new model eliminates the need to simulate in an ad hoc manner the effects of the dispersed phase on turbulence structure. The first objective of the present experiment is to provide as much information as possible about the mean and turbulent quantities with the purpose of enhancing the understanding of the occurring physical phenomena. The second is to establish a data base with enough details to assist the development and validation of mathematical models of turbulent two-phase flows. A two-color laser anemometer was used to measure the mean and fluctuating velocity components along the axial and radial directions as well as the corresponding component of the turbulent shear stress. 50 μ and 200 μ particles of glass beads were used. Results are presented for moderate loading ratios. Particular attention was given to defining the conditions at the jet exit plane since this information is essential for definite evaluation of

mathematical models of turbulent two-phase flows. The good agreement between the model predictions and the corresponding experimental data indicates that the present mathematical model allows the correct simulation of the two-phase turbulent jet.

12514 **(ERATL—83/32) 660 v in industry: an assessment of the benefits of adopting an increased level of industrial distribution voltage in the united kingdom.** Knights, D.E.; Melbourne, C.; Parr, R.G.; Turner, C.; Turner, H.W. (ERA Technology Ltd., Leatherhead (UK)). Dec 1980. 131p. NTIS, PC $690.00.

The report examines the background to the present 660V installations in Europe where East Germany standardized on 660V for industrial distribution in 1967 and several other countries both East and West European have major installations but the UK has none despite the claimed advantages of lower installations and operating costs. The characteristics of a number of typical industrial sites in Europe using 660V are examined and compared with similar sites in the UK to determine to what extent justification might exist for adopting 660V in the UK. The present availability of 660V equipment is reviewed and the safety problem discussed. A bibliography of some 80 references is included. Detailed abstracts can be found in ERA Report 78-53.

12515 **(PB—83-258145) Power factor improvement of a thyristor controlled, inductive load with fixed capacitor, thyristor-controlled reactor (fc-tcr) type compensator. Research report.** Haque, S.E.; Shepherd, W. (Bradford Univ. (UK). Postgraduate School of Electrical and Electronic Engineering). Apr 1981. 75p. NTIS, PC E04/MF E04.

A detailed analysis was carried out of a fixed capacitor thyristor-controlled reactor type compensator, for dynamic power factor correction and terminal voltage stabilization of a thyristor phase-controlled inductive load. An equation for the firing angle of the reactor and Fourier coefficient equations of the load current, supply current and compensator current were derived and compared for typical circuits. Variation with load thyristor firing angle of the rms values of these currents, the firing angle of the compensator thyristor, the power factor and other quantities were tabulated and plotted as graphs. The magnitudes of different harmonic components of the three currents were also determined. It was discovered that, for load phase angles of less than 45 degrees, the load susceptance must be such that the lagging reactive component of the fundamental component of the load current at most load thyristor firing angles.

12516 **(SAND—83-1863C) Detection of multiple sinusoids using a parallel ale.** David, R.A. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 5p. (CONF-840371—2). NTIS, PC A02/MF A01. Order Number DE84005550.

From International conference on acoustics, speech and signal processing; San Diego, CA, USA (19 Mar 1984).

This paper introduces an Adaptive Line Enhancer (ALE) whose parallel structure enables the detection and enhancement of multiple sinusoids. A function describing the performance surface is derived for the case where several line signals are buried in white noise. A steepest descent adaptive algorithm is derived, and simulations are used to demonstrate its performance.

12517 **(SAND—83-2665C) Detection of multiple sinusoids using an adaptive cascaded structure.** Ahmed, N.; Hush, D.; Elliott, G.R.; Fogler, R.J. (Sandia National Labs., Albuquerque, NM (USA); New Mexico Univ., Albuquerque (USA). Dept. of Electrical Engineering and Computer Science). 1984. Contract AC04-76DP00789. 5p. (CONF-840371—1). NTIS, PC A02/MF A01. Order Number DE84005521.

From International conference on acoustics, speech and signal processing; San Diego, CA, USA (19 Mar 1984).

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The purpose of this paper is to present a simple adaptive algorithm for detecting and tracking a sinusoid in broadband noise, while at the same time improving its signal-to-noise ratio (SNR).

12518 **Precision electronic speed controller for an alternating-current motor.** Bolie, V.W. US Patent Application 6-450,841. [nd]. 43p. Contract W-7405-ENG-36.

A high precision controller for an alternating-current multiphase electrical motor that is subject to a large inertial load. The controller was developed for controlling, in a neutron chopper system, a heavy spinning rotor that must be rotated in phase-locked synchronism with a reference pulse train that is representative of an ac power supply signal having a meandering line frequency. The controller includes a shaft revolution sensor which provides a feedback pulse train representative of the actual speed of the motor. An internal digital timing signal generator provides a reference signal which is compared with the feedback signal in a computing unit to provide a motor control signal. The motor control signal is a weighted linear sum of a speed error voltage, a phase error voltage, and a drift error voltage, each of which is computed anew with each revolution of the motor shaft. The speed error signal is generated by a novel vernier-logic circuit which is drift-free and highly sensitive to small speed changes. The phase error is also computed by digital logic, with adjustable sensitivity around a 0 mid-scale value. The drift error signal, generated by long-term counting of the phase error, is used to compensate for any slow changes in the average friction drag on the motor. An auxillary drift-byte status sensor prevents any disruptive overflow or underflow of the drift-error counter. An adjustable clocked-delay unit is inserted between the controller and the source of the reference pulse train to permit phase alignment of the rotor to any desired offset angle. The stator windings of the motor are driven by two amplifiers which are provided with input signals having the proper quadrature relationship by an exciter unit consisting of a voltage controlled oscillator, a binary counter, a pair of read-only memories, and a pair of digital-to-analog converters.

12519 **Gas flow stabilized megavolt spark gap for repetitive pulses.** Lawson, R.N.; O'Malley, M.W.; Rohwein, G.J. US Patent Application 6-440,202. [nd]. 15p. Contract AC04-76DP00789.

A high voltage spark gap switch is disclosed including a housing having first and second end walls being spaced apart by a predetermined distance. A first electrode is positioned on the first end wall and a second electrode is positioned on the second end wall. The first and second electrodes are operatively disposed relative to each other and are spaced apart by a predetermined gap. An inlet conduit is provided for supplying gas to the first electrode. The conduit includes a nozzle for dispersing the gas in the shape of an annular jet. The gas is supplied into the housing at a predetermined velocity. A venturi housing is disposed within the second electrode. An exhaust conduit is provided for discharging gas and residue from the housing. The gas supplied at the predetermined velocity to the housing through the inlet conduit and the nozzle in an annular shape traverses the gap between the first and second electrodes and entrains low velocity gas within the housing decreasing the velocity of the gas supplied to the housing and increasing the diameter of the annular shape. The venturi disposed within the second electrode recirculates a large volume of gas to clean and cool the surface of the electrodes.

12520 **Increasing capacity of baseband digital data communication networks.** Frankel, R.S.; Herman, A. US Patent Application 6-443,982. [nd]. 16p. Contract AC02-76CH00016.

This invention provides broadbank network capabilities for baseband digital collision detection transceiver equipment for communication between a plurality of data stations by affording simultaneous transmission of multiple channels over a broadband pass transmission link such as a coaxial cable. Thus, a fundamental carrier wave is transmitted on said link, received at local data stations and used to detect signals on different baseband channels for reception. For transmission the carrier wave typically is used for segregating a plurality of at least two transmission channels into typically single sideband upper and lower pass bands of baseband bandwidth capability adequately separated with guard bands to permit simple separation for receiving by means of pass band filters, etc.

4209 Waste Processing Plants And Equipment

REFER ALSO TO CITATION(S) 11678

4210 Combustion Systems

REFER ALSO TO CITATION(S) 11476, 11478, 11689, 11853, 12486, 12675

12521 **(DOE/PC/40796—8) Carbon attrition during the fluidized combustion of coal. Quarterly technical progress report, 1 June-31 August 1983.** (Naples Univ. (Italy)). 1983. Contract FG22-81PC40796. 25p. NTIS, PC A02/MF A01. Order Number DE84005681.

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The work during the period 1 June-31 August 1983 has been directed to testing attrition occurring during the batch fluidized combustion of a metallurgical coke. The metallurgical coke is that previously tested in the attrition study by means of the continuous fluidized bed experiments. Results from batch and continuous combustion of the coke are compared to each other. Data of batch combustion of the coke are also ocmpared with those found in similar experiments with the South African coal.

12522 **(DOE/PC/50257—4) Development of a coal burning pulsating combustor for industrial power.** Zinn, B.T.; Wang, M.R.; Daniel, B.R. (Georgia Inst. of Tech., Atlanta (USA). School of Aerospace Engineering). Nov 1983. Contract FG22-82PC50257. 36p. NTIS, PC A03/MF A01. Order Number DE84003386.

The research conducted under this program investigated the performance characteristics of a previously developed coal burning pulsating combustor whose design is based upon the Rijke tube principles. The combustor consists of a vertical tube opened at both ends with a fuel burning bed located in the middle of its lower half. Coal is supplied to the bed by a rotating auger-type feed system located 1 ft above the bed. Following ignition, the interaction between the combustion process and the combustor flow results in the excitation of high amplitude (up to 165 dB) fundamental, longitudinal acoustic mode oscillations with frequencies in the range 75 to 90 Hz in the combustor. Maximum amplitudes occurred near stoichiometric air/fuel ratio operation, suggesting that systems utilizing the developed combustor should possess high thermal efficiencies, as they could operate with relatively litle excess air. Both bituminous and subbituminous coals with sizes in the range 1/4" to 1/2" were burned in the developed pulsating combustor. The CO, CO_2, NO/sub x/, SO_2, O_2 and particulates concentrations in the exhaust flow were measured to evaluate the combustor performance. In tests with bituminous coal, combustion efficiencies higher than 95% for coal feed rates in the range 42 to 60 lb/ft^{2}hr were achieved with only 13% excess air while NO/sub x/ and SO_2 concentrations were comparable to those obtained with other steady state combustors. A higher performance was attained in initial tests with subbituminous coal. Finally, pulsating operation was possible under fuel rich conditions suggesting that the developed pulsating combustor could be possibly used as a gasifier.

12523 **(PB—84-118918) Analysis of low NOx operation of two pulverized-coal fired utility boilers. Final report, June 1982-July 1983.** Cherry, S.S. (KVB, Inc., Irvine, CA (USA)). Nov 1983. 45p. (KVB—72-803428-1922). NTIS, PC A03/MF A01.

The report gives results of a review of the operation of two pulverized-coal-fired utility boilers subject to the 1971 New Source Performance Standard, to determine if other boilers could adopt a similar mode of operation to reduce nitrogen oxide (NOx) emissions. These two boilers had been identified, during a previous study, as low NOx emission sources. It was determined that reburnering, burner modification, or optimization of the overfire air system of existing Foster Wheeler boilers offered the potential to significantly reduce NOx emissions. It was also determined that existing Babcock and Wilcox boilers would probably not respond to further combustion modifications.

12524 **Wood fuel use in Papua New Guinea: an assessment of the potential for industrial combustion equipment.** Mendis, M.S.; Chronowski, R.A. (MITRE Corp., McLean, VA). pp 19-23 of Proceedings of the IASTED energy symposia: modelling, policy and economics of energy and power systems; alternative energy sources and technology. Hamza, M.H. (ed.). Anaheim, CA; ACTA Press (1981). (CONF-810574—).

From International Association of Science and Technology for Development energy symposium; San Francisco, CA, USA (20 May 1981).

This paper summarizes the results of an engineering and economic assessment of new and retrofit industrial combustion equipment for wood fuel use in Papua New Guinea. Existing industrial combustion equipment and practices in Papua New Guinea are appraised. Potential industrial wood-fuel systems that utilize wood, wood wastes, charcoal and pyrolytic oils and which are particularly applicable to Papua New Guinea are identified. An economic assessment of wood-fuel systems is conducted for several case studies representative of a cross-section of Papua New Guinea industry. Conclusions and recommendations are presented to aid both government and industry in Papua New Guinea in fostering the development of appropriate wood-fuel technologies and thereby help displace the consumption of imported petroleum. 5 references, 6 figures, 3 tables.

4230 Marine Engineering

12525 **(AD-A—131547/2) DTAGS (deep towed array geophysical system) telemetry system. Final summary report.** (Electrospace Systems, Inc., Richardson, TX (USA)). 24 Jun 1983. 13p. NTIS, PC A02/MF A01.

The DTAGS telemetry system consists of the following assemblies: (1) PCM Uplink Encoder, (2) FSK Downlink Control, and (3) Cable Interface. The PCM Uplink Encoder includes the following towfish printed circuit boards: (1) Analog Interface, (2) Analog Mux, (3) Floating Point Amplifier, (4) PCM Mux and control, (5) PCM Submux, (6) Shield Board, and (7) Motherboard. The motherboard includes space for 8 GFE printed circuit boards. Also, a part of the PCM Uplink assembly was the towfish encoder chassis and a single channel digital to analog converter to be located topside. The FSK Downlink Control assembly included the FSK Encoder, located topside, and the following printed circuit boards located in the towfish: (1) FSK Decoder - 1, and (2) FSK Decoder - 2. The Cable Interface included the following towfish printed circuit boards: (1) PCM Driver, and (2) Power Isolator. Also included is a topside cable interface and equalizer which provides power isolation, separates uplink and downlink signals on the cable, and equalizes the attenuation characteristics of the cable.

12526 **(GKSS—83/E/22) Development of finite element procedures for the analysis of underwater welding of structures.** Dietrich, R.; Bathe, K.J. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.)). 1983. 76p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84750076.

A survey of our current research and development work of finite element procedures for the analysis of underwater welding of structures is presented. The fundamental heat flow and continuum mechanics equations are presented and the finite element equations are derived and discussed. Some first results, obtained in computations are presented.

4240 Pollution Control Equipment

12527 **(DOE/CS/40028—T3) Level 1 environmental assessment of cupola emissions at the Tioga Foundry.** Menzies, K.T.; Adams, J.W.; Thrun, K.E. (Little (Arthur D.), Inc., Cambridge, MA (USA)). Jan 1984. Contract AC02-76CS40028. 128p. NTIS, PC A07/MF A01. Order Number DE83017924.

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Sampling and analysis was undertaken to characterize and quantify particulate, organic and inorganic chemical concentrations

in gaseous effluents downstream of an afterburner (AFB) or stack air addition (SAA) system in a cupola at the Tioga Casting Company in Owego, New York. The US Environmental Protection Agency/Industrial Environmental Research Laboratory (EPA/IERL) Level 1 environmental assessment procedures were used to determine if the level of pollutants present differed when using the AFB versus the SAA control device for reduction of carbon monoxide (CO) concentrations.

12528 **(DOE/ER/10386—T1) Particle deposition in granular media. Annual progress report.** Tien, C. (Syracuse Univ., NY (USA). Dept. of Chemical Engineering and Materials Science). 1984. Contract AC02-79ER10386. 16p. NTIS, PC A02/MF A01. Order Number DE84005807.

The topics of investigation include: (a) further correlation of initial collection efficiency of granular fixed beds; (b) transient behavior of granular filtration in fixed beds; (c) observation of aerosol deposition in a two-dimensional filter and (d) particle reentrainment in magnetically stabilized fluidized filters. The ultimate objective of this project is to obtain a quantitative understanding of the dynamics of particle deposition in granular media. The various topics of investigation which are being studied are undertaken in order to obtain the necessary information; the synthesis of which will yield the desired quantitative knowledge. On the other hand, these topics of investigation are well-defined as individual subjects. Accordingly, they can be described separately as below.

12529 **(DOE/ET/15490—1361) Electrostatic granular bed filter development program. PFB experiment design final report.** (General Electric Co., Schenectady, NY (USA). Advanced Energy Programs Dept.). May 1982. Contract AC21-79ET15490. 74p. NTIS, PC A04/MF A01. Order Number DE83007107.

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The objective of the present study is to design an experiment which will determine the performance of an electrostatic granular bed (EGB) filter in a PFB environment. Toward this goal the following specific tasks have been accomplished: preliminary definition of the experiment using the EGB filter concept, the NY-SERDA pressure vessel and the NYU PFB facility; detailed design of the filter internals, the media recirculation system and the corona charging system; definition of the facility integration requirements; preliminary design of the instrumentation and controls required for the experiment; and initial planning for analysis of the experiment data.

12530 **(PB—83-246082) Treatment of gaseous emissions from steelplants containing small concentrations of hydrocarbon vapors. Final report, September 1978-April 1983.** Lambert, H.X.; Szekely, J. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Materials Science and Engineering). Aug 1983. 120p. NTIS, PC A06/MF A01.

The report gives results of an investigation of the feasibility of using a shallow fluidized bed of activated charcoal to remove small concentrations of hydrocarbon vapors in the presence of water vapor. This system can be applied to cleaning off-gases from sinterplants, coke ovens, and/or foundries. The investigated range of hydrocarbon vapors is 100-500 ng/cu cm air. It was found that a shallow fluidized bed of activated charcoal can efficiently remove hydrocarbons in preference to moisture at 80 C. The overall mass transfer coefficient can be calculated from data obtained in a laboratory apparatus, and the influence of various parameters on the overall reaction rate is discussed. A mathematical model based on adsorption theory is presented, which provides a means for testing the validity of the assumptions and also for preliminary scale-up calculations.

12531 **(PB—83-247585) Status of dry SO_2 control systems: Fall 1982. Final report, March 1982-February 1983.** Kelly, M.E.; Palazzolo, M.A. (Radian Corp., Durham, NC (USA)). Aug 1983. 179p. NTIS, PC A09/MF A01.

The report, updating the status of dry SO2 control systems for coal-fired utility and industrial boilers in the U.S. through the Fall of 1982, is based on current and recent research, research and development, and commercial activities. Systems addressed include: (1) spray dryer/fabric filter or electrostatic precipitator (ESP), (2) dry injection of alkali into flue gas followed by collection of particulates, (3) combustion of coal/alkali mixtures, and (4) electron-beam (E-beam) irradiation followed by particulate matter collection. Systems (1) and (2) provide both SO2 and particulate matter removal; (3) and (4) provide simultaneous SO2 and NOx control. Of the four systems, only spray drying has been commercialized; E-beam irradiation has not been tested beyond pilot scale. Including four new utility systems sold since the last status report (Fall 1981) brings the total capacity served by dry flue gas desulfurization (FGD) to about 6200 MWe.

12532 **(PB—83-256701) Phosphate extraction using fly ash.** Jensen, W.P.; Fine, L.O. (South Dakota State Univ., Brookings (USA). Water Resources Inst.). Mar 1980. 14p. NTIS, PC A02/MF A01.

The Big Stone Power Plant located on the Minnesota - South Dakota border is expected to produce 400 tons of fly ash per day during its normal operation. Fly ash has been found to reduce the orthophosphate level in water solutions. It is the insoluble part of the fly ash that is effective in removing orthophosphate from solution, and it is assumed that the active components in phosphate removal are iron and aluminum oxides. Phosphate removal efficiencies are a sensitive function of pH, with the optimum level around pH 10. It is concluded that fly ash can be used to reduce phosphate levels in surface water systems and as little as 500 ppm fly ash can be used to give near-quantitative orthophosphate removal.

12533 **(PB—83-264218) Control of air pollution emissions from molybdenum roasting. Volume 3. pilot scale test results for magnesium oxide scrubbing. Final report.** Masarky, N.H.; Burke, J.M. (Molycorp, Inc., Washington, PA (USA)). Sep 1983. 131p. NTIS, PC A07/MF A01.

A research project was conducted to determine the feasibility of applying the magnesium oxide (MgO) scrubbing system to smelter off-gas streams containing approximately one percent SO_2. Pilot scale (4000 cu Nm/hr) tests of the MgO system using a packed tower absorber with no regeneration of the MgO solids were conducted at Molycorp, Inc.'s molybdenum roaster. During the test program, process parameters were varied to observe their effect on SO2 removal, and data collected were correlated in a design equation.

12534 **(UBA-FB—82-124) Optimization of wet separators and combined systems for fine dust collection with respect to cost, separation efficiency and liquid requirements taking into account low power dust removal.** Weber, E.; Seeck, F. (Umweltbundesamt, Berlin (Germany, F.R.)). 1982. 247p. (In German). Available from Umweltbundesamt, Berlin (Germany, F.R.).

With 65 refs. and 84 figs.

Within the scope of a research and development project Venturi Scrubbers and combined dust separation systems have been investigated with respect to fine dust removal and power consumption. The pilot scale test facilities have been operated after industrial dust sources bypassing large scale dust separators. Optimization calculations have been carried out based on the operations parameters, the dust removal efficiency and shape of the apparata. A computation of the costs demonstrates comparable expences for both, single dust separators and combined systems.

12535 **Linear force coefficients for squeeze-film dampers.** Szeri, A.Z.; Giron-Duarte, A.; Raimondi, A.A. (University of Pittsburgh, Pittsburgh, PA). *American Society of Mechanical Engineers, [Paper]*; **82-LUB-30**: 9(Oct 1982). (CONF-821086—).

From ASME/ASLE joint lubrication conference; Washington, DC, USA (5 Oct 1982).

This paper presents a simplifed analysis of viscous squeeze-film damper behavior. It makes use of the notation of averaged inertia and calculates linear velocity and inertia coeffcients. These coefficients are shown to be accurate at practical values of the length/diameter ratio and the gap Reynolds number of the viscous damper.

4250 Power Cycles

REFER ALSO TO CITATION(S) 11846

12536 **(AD-A—133803/7) Usaf(united states air force), advanced terrestrial energy study. Volume 1. Project summary. Final report, September 1980-February 1982.** Daniels, E.J.; Yudow, B.D.; Donakowski, T.D. (Institute of Gas Technology, Chicago, IL (USA)). Apr 1983. 66p. NTIS, PC A04/MF A01.

The objective of this project was to develop a data base of technical and economic performance parameters of selected energy conversion and energy storage devices. The data base includes not only the state-of-the-art (1980) values of performance parameters, but also the expected values of performance parameters in 1985, 1990, and 2000. For energy conversion technologies, performance parameters were developed over a power output from 1.5 to 5000.0 kW. For energy storage technologies, performance parameters were developed over an energy output range equivalent to the power output at continuous annual operation. The following energy conversion technologies were characterized in this data base: Gas turbines -- Closed cycle and Open cycle, (recuperative and nonrecuperative); Diesels -- Turbocompounded, Turbocharged and Adiabatic; Stirlings -- Free piston and Kinematic; Organic Rankine Cycles; Fuel cells -- Phosphoric acid, Solid polymer electrolyte and Molten carbonate; Photovoltaics -- Flat plate, Actively cooled and Photochemical; and Wind turbines -- Vertical and horizontal axes. The following energy storage technologies were characterized: Batteries -- Zn/Cl2, Zn/Br2, Ni/Fe, Li-Al/FeS2, Na/S, Advanced sealed lead/acids and Redox Cr-Fe; and Thermal energy storage devices -- $CaCl_26H_2O$, $Na_2SO_410H_2O$, $Na_2S_2O_35H_2O$, Olivine and Magnesite ceramic brick, and Form-stable polyethylene.

43 PARTICLE ACCELERATORS

4301 Design, Development, And Operation

REFER ALSO TO CITATION(S) 12560, 12561, 12980, 12981

12537 (CERN—83-02(Vol.2), pp 443-461) **Nuclear beams from PS and SPS.** Haseroth, H. (European Organization for Nuclear Research, Geneva (Switzerland)). 10 Feb 1983. NTIS (US Sales Only), PC A23/MF A01. (CONF-821256—Vol.2).

From Workshop on SPS fixed-target physics in the years 1984-1989; Geneva, Switzerland (6 Dec 1982).

The history of light ions at CERN is presented and the possibilities are outlined on how to accelerate heavier nuclei than deuterons and α-particles. Intensity estimates are given and the problems of the different accelerators are discussed. There are difficulties and limitations, not only due to the low intensities, but also due to the low charge to mass ratio.

12538 **(EFI—523(10)-82) Experimental equipment and technique for formation and investigation of parameters of quasimonochromatic and polarized photon beams at the Erevan Synchrotron.** Avakyan, R.O.; Avetisyan, A.Eh; Armaganyan, A.A. (Erevanskij Fizicheskij Inst. (USSR)). 1982. 25p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704334.

The experimental equipment and technique for the formation and investigation of parameters of quasimonochromatic and polarized coherent bremsstrahlung photon beams at the Erevan electron synchrotron are described.

12539 **(FERMILAB-CONF—84/18) Computing tools for accelerator design calculations.** Fischler, M.; Nash, T. (Fermi National Accelerator Lab., Batavia, IL (USA)). Jan 1984. Contract AC02-76CH03000. 7p. (CONF-831264—1). NTIS, PC A02/MF A01. Order Number DE84005825.

From Workshop on accelerator physics issues for a superconducting super collider; Ann Arbor, MI, USA (12 Dec 1983).

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This note is intended as a brief, summary guide for accelerator designers to the new generation of commercial and special processors that allow great increases in computing cost effectiveness. New thinking is required to take best advantage of these computing opportunities, in particular, when moving from analytical approaches to tracking simulations. In this paper, we outline the relevant considerations.

12540 (JINR-D—1,2-82-27, pp 216-223) **Polarized proton acceleration program at the A6S.** Lee, Y.Y. (Brookhaven National Lab., Upton, NY (USA)). 1982. NTIS (US Sales Only), PC A15/MF A01. (CONF-811147—).

From International symposium on polarization phenomena at high energies; Dubna, USSR (17 Nov 1981).

The major modifications and impovements at the Brookhaven AGS to accelerate the polarized protons are shown. The essentials of the ion source are presented. Polarized negative ion source current of 22 μA is expected. A radio-frequency quadrupole linear accelerator is being built. To jump the intrinsic resonances the standard method of pulsing the quadrupoles to rapidly changing the vertical tune of the AGS is used. Conceptual diagram of correction dipole controls is given. The first polarized proton acceleration at the AGS with polarization of over 60 percent up to 26 GeV/c with the intensity of 10^{11} approximately 10^{12} per pulse is expected in 1983.

12541 (JINR-D—1,2-82-27, pp 151-160) **Polarization research and facilities at LAMPF.** McNaughton, M.W. (Los Alamos National Lab., NM (USA)). 1982. NTIS (US Sales Only), PC A15/MF A01. (CONF-811147—).

From International symposium on polarization phenomena at high energies; Dubna, USSR (17 Nov 1981).

Preliminary data on polarization research at LAMPF are presented. The description of the Lamb-shift polarized ion source, polarized beam experimental areas, carbon polarimeter for spin transfer measurements are given. Spin transfer measurements from 300 to 800 MeV with all (N, S, L) spin directions, and energetic program is being pursued in several beam lines simultaneously. Elastic pp measurements at a few energies are making good progress but polarized neutron experiments are lagging. The problem of understanding the inelastic reactions has scarcely begun.

12542 (JINR-D—1,2-82-27, pp 31-41) **Fermislab polarized beams and associated experimental topics.** Yokosawa, A. (Argonne National Lab., IL (USA)). 1982. NTIS (US Sales Only), PC A15/MF A01. (CONF-811147—).

From International symposium on polarization phenomena at high energies; Dubna, USSR (17 Nov 1981).

The description of the full-energy beam line as well as on economized version for the construction of the polarized beam at Fermilab up to 500 GeV/c are given. The conventional BM 105 magnets are used for dipoles. A prototype superconducting quadrupole has been built. A universal set of spin precession magnets would be eight magnets of at least 27.4 kG/m field integral which fit into roughly 16 m and have 5-inch gaps. The power supplies could be ramped and the magnet polarities switched on a spill-to-spill basis. The spin-reversing scheme is given. Estimated polarized-beam intensities are presented. The plan of the first-round experiments is given. The first-round and dilepton-production experimental setups are presented.

12543 **Modelling of multiple electrode Van de Graaff generators with up-charge and down-charge processes.** Takacs, J. (Nuclear Physics Lab., Univ. of Oxford, Oxford). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2749-2753(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

Van de Graaff generators with multiple electrodes came about as a result of the demand for ever increasing voltages in various fields of science. The transient behaviour of these generators is mostly determined by their internal electrode arrangements. In the analysis given here these effects are divided into two categories; the effect of the column electrode structure and that caused by the large intermediate shields. The modelling shown here takes into consideration both effects and shows the way of analysing these high voltage generators with up to n internal electrodes. The re-

sults show the striking difference in behaviour of these generators with up-charge and down-charge processes. The numerical example given was based on one of the existing Van de Graaff generators in Oxford.

12544 **Millimeter high power sources for high gradient accelerators.** Prosnitz, D. (Lawrence Livermore Nat'l Lab., P.O. Box 808/L-321, Livermore, CA 94550). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 2754-2757(Aug 1983). (CONF-830311—). Contract W-7405-ENG-48.

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The potential for achieving high accelerator gradients with high power rf sources is evaluated.

12545 **Improved field stability in RFQ structures with vane coupling rings.** Schneider, H.R.; Lancaster, H. (Lawrence Berkeley Lab., Univ. of Calif., Berkeley, CA 94720). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 3007-3009(Aug 1983). (CONF-830311—). Contract AC03-76SF00098.

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The small apertures common in many RFQ linac designs lead to tuning difficulties, primarily because asymmetries in the quadrant fields can arise as a result of small non-uniformities in the vane to vane capacitances. Sensitivity to such capacitance or other tuning variation in the quadrants is greatly reduced by the introduction of pairs of vane coupling rings that provide periodic electrical connections between diametrically opposite vanes. Results of measurements on a cold model RFQ structure with and without vane coupling rings are presented. The number of rings required for field stabilization and the effect of rings on mode frequencies are discussed.

12546 **Design, construction and performance of the INS RFQ LINAC 'LITL'.** Ueda, N.; Arai, S.; Hattori, T.; Hirao, Y.; Itano, A.; Mizobuchi, A.; Nakanishi, T.; Takanaka, M.; Tokuda, N.; Yamada, S. (Inst. for Nuclear Study, Univ. of Tokyo, Tanashi, Tokyo 188). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 2975-2979(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

An RFQ LINAC 'LITL' (Lithium Ion Test Linac) was constructed and accelerated ion beams of H^+, H_2^+, H_3^+, $^3He^+$, $^6Li^+$ and $^7Li^+$. The machine was designed to accelerate particles with charge to mass ratio (q/A) of 1 about 1/7 injected at 5 keV/u up to 138 keV/u. The acceleration cavity of four vane structure is 56 cm in diameter and 138 cm in length. Transmission exceeding 90% has been obtained for proton beam of 80 μA. The acceleration characteristics agree well with the computer simulation with PARMTEQ. For the acceleration of $^7Li^+$, an rf power of 22 kW is fed with a loop coupler. In cw operation, an electric field of 205 kV/cm has been applied, which is required for $^7Li^+$ acceleration and corresponds to 1.8 times the Kilpatrick's criterion. A maximum field of 2.0 times the criterion has been achieved, in pulse operation, with a duration width of 5 ms and repetition period of 25 ms. Operation of the machine is easy and stable.

12547 **Post-coupler and stem current measurements for high current CW drift-tube linacs.** Ungrin, J.; Schriber, S.O.; Vokes, R.A. (Atomic Energy of Canada Limited, Research Company, Chalk River Nuclear Laboratories, Chalk River, Ontario, KOJ 1JO). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 3013-3015(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

Post-coupler characteristics have been measured on a model Alvarez tank for drift-tube-to-outer tank diameter ratios from 0.10 to 0.25. A maximum ratio beyond which field stabilization is not possible and a minimum ratio where stabilization is difficult have been determined. Field stabilization has been studied using two to twenty-one post couplers in a 22 cell tank. A sensitive dependence of the drift-tube stem currents near the tank end walls on the end cell geometry has been found.

12548 **A multidimensional study of a 50-MeV, 1500-rad/pulse radiographic linac, using the stagger-tuning concept.** Owen, R.K.; Boyd, T.J.; Fazio, M.V. (AT-5, MS H827, Los Alamos Nat.'l Lab., Los Alamos, NM 87545). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 3027-3029(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

Stagger tuning of accelerator cavities, or blocks of cavities, can significantly enhance the achievable charge transfer through an electron linac operating in the stored-energy mode. The output bremsstrahlung flux can be increased over a conventional approach by an order of magnitude without any significant degradation in emittance growth or energy spread. Given a suitable injector, a 1500-rad/pulse, 50-MeV radiographic linac appears to be practical at a 400-MHz operating frequency; a 150-rad/pulse, 50-MeV radiographic linac will operate at 1300 MHz. A multidimensional study was made using the PARMELA code where several parameters, including beam current, synchronous phase angle, and beam radius, were varied while observing the effects on emittance and transmission efficiency.

12549 **Recent performance improvements on FXR.** Kulke, B.; Kihara, R. (Lawrence Livermore Nat.'l Lab., Livermore, CA 94550). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 3030-3032(Aug 1983). (CONF-830311—). Contract W-7405-ENG-48.

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The FXR machine is a nominal 4 kA, 20 MeV, linear induction, electron accelerator for flash radiography at LLNL. The machine met its baseline requirements in March 1982. Since then, the performance has been greatly improved. The authors have achieved stable and repeatable beam acceleration and transport, with over 80% transmission to the tungsten bremsstrahlung target located some 35 m downstream. For best stability, external beam steering has been eliminated almost entirely. They regularly produce over 500 Roentgen at 1 m from the target (TLD measurement), with a radiographic spot size of 3-5 mm. Present efforts are directed towards the development of a 4 kA tune, working interactively with particle-field and beam transport code models. A remaining uncertainty is the possible onset of RF instabilities at the higher current levels.

12550 **Industrial and medical applications of accelerators with energies less than 20 MeV.** Duggan, J.L. (North Texas State Univ., Denton, TX 76203). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 3039-3043(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

In this paper the medical and industrial application of small accelerators is reviewed. Most of the material is taken from the Seventh Conference on the Application of Accelerators in Research and Industry, which was held in Denton, Texas in November of 1982. The areas covered include medical linacs, cyclotron design and production of medical radioisotopes, radiation processing, ion implantation for the metallurgical and semiconductor industries, oil and mineral exploration, trace, surface and bulk analysis, and unique accelerators for all of the above applications.

12551 **Status of the SNS.** Rees, G.H. (Rutherford Appleton Lab., Chilton). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 3044-3048(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The current status of the SNS Project is outlined, with more emphasis on the details of the 50 Hz, 800 MeV proton synchrotron

than on the high intensity neutron target. Points of interest in the synchrotron and target hardware are given.

12552 **Design considerations on peak electrical fields and maximum beam currents for heavy ion RFQ linacs.** Junior, P.; Deitinghoff, H.; Halfmann, K.D.; Neumann, W.; Zoubek, N. (Institut fur Angewandte Physik der Universitat Frankfurt am Main, Robert-Mayer-Str. 2-4, D-6000 Frankfurt am Main). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2639-2641(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

Aperture and frequency determine voltage limits with respect to sparking. For a corresponding application of Kilpatrick's criterion exact knowledge of peak electrical fields in the RFQ is required. Results of calculations for Bi^{2+} fusion injectors considered in this institute are presented. As a general result maximum beam current turns out approximately proportional to electrode voltage. Some notes on the influence of space charge models are reported.

12553 **A high performance control system for a heavy ion medical accelerator.** Lancaster, H.D.; Magyary, S.B.; Sah, R.C. (Lawrence Berkeley Laboratory, University of California, Berkeley, CA 94720). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2311-2313(Aug 1983). (CONF-830311—). Contract AC03-76SF00098.

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

A high performance control system is being designed as part of a heavy ion medical accelerator. The accelerator will be a synchrotron dedicated to clinical and other biomedical uses of heavy ions, and it will deliver fully stripped ions at energies up to 800 MeV/nucleon. A key element in the design of an accelerator which will operate in a hospital environment is to provide a high performance control system. This control system will provide accelerator modeling to facilitate changes in operating mode, provide automatic beam tuning to simplify accelerator operations, and provide diagnostics to enhance reliability. The control system being designed utilizes many microcomputers operating in parallel to collect and transmit data; complex numerical computations are performed by a powerful minicomputer. In order to provide the maximum operational flexibility, the Medical Accelerator control system will be capable of dealing with pulse-to-pulse changes in beam energy and ion species.

12554 **Magnetic losses in metallic glasses under pulsed excitation.** Smith, C.H. (Metglas Products, 6 Eastmans Rd., Parsippany, NJ 07054). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2918-2920(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

Magnetic losses in ferromagnetic metallic glasses are discussed with respect to their use in particle accelerators. Domain models for magnetization under fast pulse conditions are discussed and compared to experimental measurements.

12555 **Radio-frequency accelerators for multi-kiloampere electron beams.** Humphries, S. Jr.; Hwang, C.S. (Dept. of Chemical and Nuclear Eng., Univ. of New Mexico, Albuquerque, NM 87131). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2986-2988(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

Most present work on intense pulsed electron beam accelerators is aimed toward linear induction accelerators. In this paper the authors consider the application of resonant accelerators to the generation of pulsed multi-kiloampere electron beams. The main relative advantages are that low cost and high voltage gradient can be achieved by eliminating ferromagnetic isolation cores; that cavity designs are simpler (with optimum utilization of vacuum insulators); and that there are no high voltage shorting switches. The last feature implies that RF accelerators may operate at higher repetition rate and duty cycle. The authors discuss RF cavities filled with water. The high attainable dielectric constant raises the stored energy density by a factor greater than 60 for enhanced pulsed operation. The lower impedance of the cavity also permits CW operation in the 10-50 A level. The discussion treats, in order, the functions a water-filled cavity can perform and the configuration of a high current RF accelerator; the power losses in the cavity walls and dielectric medium; the effects of water heating and cavity distortion on the resonant frequency; the baseline parameters for a 750 kV cavity; and, in the last section, the problem of beam loading in CW operation.

12556 **Heavy ion fusion.** Bock, R. (GSI Darmstadt). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 3049-3054(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

Two accelerator scenarios for heavy ion fusion are considered as driver candidates for an ICF power plant: the RF linac with storage rings and the induction linac. The necessary beam intensity and beam quality requirements are already believed to be achievable in the long run; repetition rate and accelerator efficiency are not critical issues. Conceptual design studies have indicated that the technical problems of the ICF concept with a heavy ion driver can be solved and that the economical aspects are not prohibitive as compared to other ICF concepts. Nevertheless, many open problems still exist, and some new ones have exhibited themselves, and it has become evident that most of them cannot be investigated with existing facilities and at the present level of effort. The first section of this paper deals with current conceptual design studies and focuses on the interface between the accelerator and the reactor. The second section summarizes the present research programs and recommends that their scope should be expanded and intensified in the areas of accelerator physics and beam-target interaction and target physics. In the third section the author calls for a dedicated facility and reports on the plans and ideas for such a facility. Schematics of two proposed accelerator driver systems--the driver for HIBALL (5 MJ/pulse) and a single-pass four-beam induction linac (3 MJ/pulse)--are provided.

12557 **New methods to correct on-line the closed orbit of a synchrotron accelerator with variable focusing configuration.** Burnod, L.; D'Amico, E. (CERN, 1211 Geneva 23). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2284-2286(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

A high energy proton synchrotron operating as an accelerator for fixed target physics often has a simple periodic structure at least at the design stage. For a given plane, horizontal or vertical, beam position detectors (BP) and closed orbit correction dipoles (COD) can be located near the quadrupoles where the betatronic amplitude and the phase advance are constant from one element to the next. The closed orbit correction is then straightforward using the simple beam bump method on three adjacent COD's. Transforming such an accelerator into a proton-antiproton collider significantly alters its periodicity. To increase the luminosity, low beta configurations are inserted at the crossing points, changing the betatronic amplitude and phase advance around the ring and modifying the physical layout of the BP's and COD's. New types of BP's are required locally for proton and antiproton detection as well as new types of COD's to correct the closed orbit at any energy inside the beta insertions. Furthermore, the working points and the low beta configurations can vary from one experiment to another. For synchrotrons having such an irregular and variable configuration it becomes necessary to define a software package independent of the configuration. New fast algorithms are needed to correct the closed orbit on-line. These algorithms should take into account the finite strength of the COD's and the fact that at some places there are not enough COD's available for the beam bump method at high energy. Such a software package is presented in this paper.

12558 **CW side-coupled linac for the Los Alamos/NBS racetrack microtron.** Young, L.M.; Potter, J.M. (AT-1. MS H817, Los Alamos Nat.'l Lab., Los Alamos, NM 87545). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 3508-3510(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

A 2.7-m side-coupled linac has been built as part of the 5-MeV injector for the cw room-temperature racetrack microtron (RTM) being constructed in collaboration with the National Bureau of Standards (NBS). The linac is designed to accelerate the electron beam from 1 to 5 MeV with an accelerating gradient of 1.5 MeV/m. Fabrication of the structure started October 4, 1982 and was completed February 28, 1983, when it was tested with a cw power level of 82 kW. The structure has an effective shunt impedance (ZT^2) of 82.5 MΩ/m. No change in field distribution was detected at any power level. The operating frequency is 2380 MHz.

12559 **Variable-energy drift-tube linear accelerator.** Swenson, D.A.; Boyd, T.J. Jr.; Potter, J.M.; Stovall, J.E. US Patent Application 6-398,507. [nd]. 19p. Contract W-7405-ENG-36.

A linear accelerator system includes a plurality of post-coupled drift-tubes wherein each post coupler is bistably positionable to either of two positions which result in different field distributions. With binary control over a plurality of post couplers, a significant accumulative effect in the resulting field distribution is achieved yielding a variable-energy drift-tube linear accelerator.

4302 Beam Dynamics, Field Calculations, And Ion Optics

REFER ALSO TO CITATION(S) 12539, 12542, 12559, 12597, 12613, 12642, 12643

12560 (CERN—83-02(Vol.2), pp 396-421) **Acceleration of polarized protons at CERN.** Bovet, C.; Moehl, D.; Ruth, R. (European Organization for Nuclear Research, Geneva (Switzerland)). 10 Feb 1983. NTIS (US Sales Only), PC A23/MF A01. (CONF-821256—Vol.2).

From Workshop on SPS fixed-target physics in the years 1984-1989; Geneva, Switzerland (6 Dec 1982).

The purpose of this paper is three-fold. First, we introduce the basic problems associated with acceleration of polarized protons. We include a discussion of depolarizing resonances, the behavior of the spin in the neighbourhood of resonance, and the standard cures for the problem of resonant depolarization. The first section is concluded with a discussion of the "Siberian Snake", a "global cure" which is appropriate for large machines such as the SPS. In the next section polarized protons for the PS is discussed with the view towards the SPS. Finally, we conclude with a discussion of polarized protons in the SPS. The cure for depolarization selected here is a "Siberian Snake". Details such as the magnets required, location of the device, and mode of operation are discussed.

12561 (CERN—83-02(Vol.2), pp 422-424) **Crossing of depolarization resonances at Saturne (Saclay).** Grorud, E.; Nakach, A. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Lab. National Saturne). 10 Feb 1983. NTIS (US Sales Only), PC A23/MF A01. (CONF-821256—Vol.2).

From Workshop on SPS fixed-target physics in the years 1984-1989; Geneva, Switzerland (6 Dec 1982).

12562 **(CONF-8305127—4) Surfatron laser-plasma accelerator: prospects and limitations.** Joshi, C. (California Univ., Los Angeles (USA). Dept. of Electrical Engineering). 1983. Contract AS08-81DP40163. 15p. NTIS, PC A02/MF A01. Order Number DE84005497.

From Spring college on radiation in plasmas; Trieste, Italy (24 May 1983).

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The surfatron laser-plasma accelerator is an extension of the plasma beat wave accelerator scheme. It utilizes very intense electric fields, 10^9 to 10^{10} V/cm, associated with focussed laser beams to accelerate particles. (GHT)

12563 **(DOE/SF/00515—T25) Effect of magnet alignment jittering in the damping ring and RTL on wake fields in the linac.** Chao, A.; Rivkin, L. (Stanford Linear Accelerator Center, CA (USA)). Jan 1984. Contract AC03-76SF00515. 5p. (SLAC-CN—263). NTIS, PC A02/MF A01. Order Number DE84005841.

In order to reduce the beam emittance blow-up due to wake fields in the linac to a tolerable level, it is necessary that the beam injection into the linac does not jitter too much. The tolerance is set to be +- 13 μm in displacement or +- 0.3 μrad in angle at the injection point where E = 1.2 GeV. This tolerance assumes β = 42 m at the injection point and represents about 2% of the local rms beam size. One potential source of injection jitter comes from the damping ring ejection kicker. Another - which is the subject of this study - is due to the jittering in the alignments of the damping ring and RTL magnets (due to earth motion, nearby pumps, etc.). We assume this alignment jittering is random from magnet to magnet. (If we do not plan to have a fast feedback at the linac injection point; these misalignments do not have to jitter from pulse to pulse; they could be slowly oscillating in time and be equally harmful.) We estimate the tolerance on the magnet alignment jittering to be 0.1 μm.

12564 **(FRNC-TH—1164) Profile measurements by ondulator radiation of proton and anti-proton beams.** Meot, F. (Institut National Polytechnique, 38 - Grenoble (France)). Dec 1981. 78p. (In French). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84750423.

Portions are illegible in microfiche products.

The CERN SPS synchrotron is presently under transformation in a proton-antiproton storage ring. As part of this plan, circulating beams must be adjusted. After a first experiment of synchrotron radiation operation, reserved up to now to high intensity and high energy proton beams, a system, based on the use of light emitted by particles crossing the ondulator periodic magnetic field, is decided to be realized. Context and nature of this plan are presented in this thesis, together with details of elaboration and realization. To conclude, first experimental results on the proton ondulator radiation are presented.

12565 **(INIS-mf—8581) Resonance and coupling effects in circular accelerators.** Corsten, C.J.A. (Technische Hogeschool Eindhoven (Netherlands). Afdeling der Elektrotechniek). 17 Sep 1982. 140p. NTIS (US Sales Only), PC A07/MF A01. Order Number DE83704234.

This thesis deals with a general theory for the description of resonance and coupling effects in circular particle accelerators. The theory is mainly applied to the proposed proton accumulator ring IKOR in West Germany and to an electron storage ring which is characteristic of existing synchrotron radiation facilities (PAMPUS; this project has since been dismissed by the Dutch government). In chapter 1 the author expands the general Hamilton function for the description of the relativistic particle motion in a time-dependent magnetic field and a HF accelerating electric field (in order to study transverse-longitudinal coupling effects) as well as for the motion in a time-independent magnetic field without acceleration (to study transverse coupling effects). The linear transverse motion is discussed in chapter 2. Analytical formulae for the so-called Twiss parameters are derived from the linear Hamilton theory. The simultaneous treatment of the betatron and synchrotron motion is developed in chapter 3 and a theory for the description of the one-dimensional non-linear betatron motion is elaborated in chapter 4. The two-dimensional non-linear betatron resonances are treated in chapter 5. The description of these resonances can be reduced rather simply to a one-dimensional problem and are treated by examination of trajectories in a phase plane.

12566 (KFTI—81-52, pp 55-56) **Optimization of radialphase motion in accelerator with accelerating-field focusing.** Alisherov, A.A.; Ovsyannikov, D.A. (Leningradskij Gosudarstvennyj Univ. (USSR)); Papkovich, V.G.; Shulika, N.G. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1981. (In Russian). NTIS (US Sales Only), PC A05/MF A01. (CONF-8106218—No.3(9)).

From 7. all-union seminar on linear accelerators; Kharkov, Ukrainian SSR (2 Jun 1981).

Technique for optimization of radialphase motion of a charged particle beam in an accelerator with variable-phase focusing is suggested. Unlike the works, where beam motion was determined with dynamics of each particle separately, here, equations describing change in ellipse parameters of beam phase states in the radial plane are considered with provision for radial beam motion. A numerical method of directional search for accelerating structure parameters satisfying to the given requirements has been developed on the basis of the accepted mathematical model of beam motion.

12567 **(SLAC/AP—10) Coherent synchro-betatron oscillations excited by the beam-beam interaction.** Kamiya, Y.; Chao, A.W. (Stanford Linear Accelerator Center, CA (USA)). Dec 1983. Contract AC03-76SF00515. 12p. NTIS, PC A02/MF A01. Order Number DE84005896.

In this note, a third possible coherent instability excited by the beam-beam interaction will be discussed. This time it involves the longitudinal motion of the bunches. What is studied is the possibility of beam-beam excited longitudinal dipole oscillations or coherent synchro-betatron oscillations in which the longitudinal and transverse motions are coupled through the beam-beam collisions. We suggest that such modes of oscillations exist when there is a finite dispersion at the interaction point.

12568 **(SLAC/AP—11) Second order particle motion equations and linear chromaticity calculation in accelerator rings.** Liu, R.Z. (Stanford Linear Accelerator Center, CA (USA)). Jan 1984. Contract AC03-76SF00515. 47p. NTIS, PC A03/MF A01. Order Number DE84005895.

The first part of this note presents a thorough study on the second order particle motion equations, both in continuous field and in hard edges, with emphasis put on the latter. Having quite general conditions and strict mathematical treatments, it provides a sound ground from which many problems can be solved without fear of being misled. Then the linear CHR calculation is inspected, the first step being a general analytical expression of the transverse oscillation phase increment due to a small disturbance. The expression for the CHR is then readily obtained since tune is the transverse oscillation number per turn and the CHR is the linear dependence of the tune on particle energy/momentum deviation. The last part gives the formulae for practical CHR calculation, which are general enough to include almost all the magnet types commonly used in various accelerator rings and are simpler than can be found elsewhere.

12569 **(SLAC/AP—12) Techniques in machine function integral calculations.** Liu, R.Z. (Stanford Univ., CA (USA)). Jan 1984. Contract AC03-76SF00515. 28p. NTIS, PC A03/MF A01. Order Number DE84005894.

This note is a summary of machine function integral expressions the author has accumulated in several years' work on accelerator physics. It is not of theoretical importance, but it can help much in practical calculation. Many accelerator physicists have noticed that to express such integrals by functions at some special points and parameters of the magnet in question has an advantage over step-by-step summation, owing to less time elapsed and better accuracy obtained. However, most of the formulae they present in papers or programs still have much room for simplification. To express the integrals as simply as possible saves time, and it can help set some parameters as function of goodness or fit function in searching for an ideal lattice configuration, though the parameters are usually considered too complicated.

12570 **(SLAC-PEP-NOTE—132) Evaluation of the field quality of the prototype PEP cell quadrupole magnet.** Chao, A.W.; Lee, M.J.; Morton, P.L. (Stanford Linear Accelerator Center, CA (USA)). Sep 1975. Contract AC03-76SF00515. 8p. NTIS, PC A02/MF A01. Order Number DE84003216.

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The purpose of this note is to determine the acceptability of the PEP Prototype Quadrupole 127Q780 profile for use in all quadrupoles except Q2 and Q3. The dependence of the betatron frequency upon the particle energy and betatron amplitude has been determined for the case where the nonlinear field impurities of the 127Q780 are present in the following quadrupoles: Q1, QF1, QD1, QF2, QF, QD, QF3, QD2, QS1 and QS2. It was assumed that quadrupoles Q2 and Q3 were perfect with no nonlinear field impurities. The method used to calculate the values of the betatron frequencies has been reported elsewhere and we present only the results. The tune shifts given here are due to only the nonlinear fields in the quadupoles and do not include those due to the natural chromaticity of the lattice or the correcting sextupoles.

12571 **The status of electron cooling at Novosibirsk (theory and experiment).** Derbenev, Ya.S.; Dikansky, N.S.; Kudelainen, V.I.; Lebedev, V.A.; Meshkov, I.N.; Parkhomchuk, B.B.; Pestrikov, D.V.; Skrinsky, A.N.; Sukhina, B.N. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 2672-2676(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

In this report the recent developments on electron cooling at the Nuclear Physics Institute, Novosibirsk are given. Problems of getting of electron beam with low effective temperature, suitable for fast electron cooling, are discussed.

12572 **Electron cooling and accumulation of 200 MeV protons at Fermilab.** Ellison, T.; Kells, V.; Kerner, V.; McIntyre, P.M.; Mills, F.; Peters, R.; Rathbun, T.; Young, D. (Fermi Nat.'l Accelerator Lab., P.O. Box 500, Batavia, IL 60510). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 2636-2638(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

Experimental measurements have been made of the cooling of 200-MeV protons by an electron beam of 1 to 3 A and an energy of 110 keV. These experiments are an extention of earlier measurements on the cooling of 115-MeV protons and were performed in the Fermilab experimental proton storage ring. At 200 MeV the proton beam lifetime in the storage ring is extended from 10 to 4000 sec with electron cooling. The cooling times with an electron beam current of 1 A were approximately 2 sec for momentum and 5 to 10 sec for transverse cooling of the proton beam. For proton intensities of approximately 2×10^6 particles, the six-dimensional phase-space density of the proton beam was increased by a factor of 2×10^5. These results and data on equilibrium proton distributions and frictional forces are in reasonable agreement with the theoretical predictions. In addition, the accumulation of successive "hot" batches of protons into a cold core, i.e. stacking, has been demonstrated.

12573 **A formulation of transversely coupled betatron stochastic cooling of coasting beams.** Chattopadhyay, S. (SPS Division, CERN, 1211 Geneva 23). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 2652-2654(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

A formulation of stochastic cooling with coupled degrees of freedom, with emphasis on the tensorial signal suppression phenomenon for transversely coupled betatron stochastic cooling of coasting beams, is provided. The relevant expressions for the damping and diffusion coefficients and the elements of the signal suppression tensor are given in terms of the general cooling interaction harmonics. The formulation is necessarily abstract in order to provide a

general framework of quantitative analysis and demands exact knowledge of the nature of the coupling interaction for it to be useful in any particular case.

12574 **Beam optics for a 12 GeV isochronous ring cyclotron.** Baartman, R.; Laxdal, R.; Lee, R.; Mackenzie, G.H. (TRIUMF, 4004 Wesbrook Mall, Vancouver, B.C., V6T 2A3). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 2010-2012(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

This paper discusses the tolerances required for isochronous cyclotrons accelerating protons to kaon and p^- producing energies. The beam traverses many more imperfection resonances and low order intrinsic resonances than in existing cyclotrons since the isochronous radial tune v /SUB r/ $\approx$Y. The authors anticipate an incoherent radial amplitude of 1 mm at extraction. The turns will overlap and the net accelerating voltage must be flattopped to ensure that all particles make the same number of turns. With these conditions a 1 G imperfection at the final integer resonance develops 3 mm coherent amplitude, and although some non-linear stretching takes place, a clear space of 0.8 mm permits insertion of a septum. To preserve 1 mm amplitude the operational imperfection fields and gradients at other resonances must be less than 0.10 G and 0.10 G/cm. A third order intrinsic resonance will cause some filamentation and impair extraction efficiency, although this can be partially controlled.

12575 **Longitudinal instabilities with a non-harmonic RF potential.** Krinsky, S.; Wang, J.M. (Brookhaven Nat.'l Lab., Upton, NY 11973). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 2492-2494(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The authors consider the longitudinal instabilities of a bunched beam subject to a non-harmonic RF potential. Assuming the unperturbed bunch to be described by a Maxwell-Boltzmann distribution, their treatment is based upon the linearized Vlasov equation. The formalism developed is exact, and in particular, correctly describes the effect of the dependence on amplitude of the synchrotron oscillation frequency. The authors discuss the fast blowup limit and extend Wang and Pellegrini's treatment of the microwave instability to include the case of a non-Gaussian bunch. Next, within the short bunch approximation, the authors derive the dispersion relation describing the Landau damping of the coupled bunch modes, resulting from the use of a Landau cavity.

12576 **Longitudinal instabilities of long Gaussian bunches.** Krinsky, S.; Wang, J.M. (Brookhaven Nat.'l Lab., Upton, NY 11973). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 2495-2497(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The authors present an overview of the longitudinal instabilities of Gaussian bunches subject to a harmonic RF potential. Their emphasis is on the behavior of long bunches having lengths greater than the wavelength of the perturbinG electromagnetic fields. The authors exhibit the crossover between the dominance of the synchrotron modes and the coasting-beam-like distortions of the bunch distribution, which occurs as the real or imaginary part of the coherent oscillation frequency becomes large compared to the synchrotron oscillation frequency. For a narrow band impedance the growth rate of the coasting-beam-like modes is determined by the average beam current, and for a broad band impedance the growth rate is determined by the peak current. The authors discuss the transition between these two regimes by considering the growth rate as a function of the bandwidth of the impedance.

12577 **Threshold behavior for longitudinal stability of induction linac bunches.** Bisognana, J.; Haber, I.; Smith, L. (Lawrence Berkeley Lab., Univ. of Calif., Berkeley, CA 94720). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 2501-2503(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The induction linac bunches of heavy ion fusion scenarios are strongly influenced by the longitudinal space charge impedance. This is in distinct contrast to relativistic bunches in storage rings where most of the data on stability have been obtained. Simulation results reveal that when space charge effects are large, the stability requirement of small growth rate relative to the synchrotron frequency for relativistic bunches is replaced by the relaxed condition of small growth rate relative to the frequency spacing of the space charge wave modes on the bunch. Dispersive effects from finite pipe size tend to make the lower frequencies less susceptible to instability than higher frequencies. Since induction modules have a high resistive component only for the lowest bunch modes, stability is better than would occur for a broadband impedance of comparable magnitude. These results indicate that long term longitudinal bunch stability is realizable for induction linac drivers for heavy ion fusion.

12578 **Stabilization of longitudinal modes in a high current betatron.** Lee, E.P.; Faltens, A.; Laslett, L.J.; Smith, L. (Lawrence Berkeley Lab., Univ. of Calif., Berkeley CA 94720). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 2504-2506(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The momentum spread required to stabilize longitudinal modes in a proposed high current betatron is computed.

12579 **Emittance growth of high current beams in transport lines.** Bongardt, K. (Kernforschungszentrum Karlsruhe und Universitat Karlsruhe, Institut fur Kernphysik, Postfach 3640, D-7500 Karlsruhe). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 2560-2562(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The rms emittance increase of high current beams in transport lines, caused by nonlinear space charge forces, can be understood as the development of the initial particle distribution to an equilibrium one. For a small beam radius, one gets less rms emittance increase and the equilibrium distribution is reached earlier than for a large beam radius. The beam can now be transported over a long distance without further rms emittance growth in all 3 directions. These results are incorporated in the design of a funneling section for the high current linear accelerator of the HIBALL concept.

12580 **Imagescope to photodiode beam-profile imaging system.** Chamberlin, D.D.; Hollabaugh, J.S.; Stump, C.J. Jr. (Los Alamos Nat.'l Lab., Los Alamos, NM 87545). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 2201-2203(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

Transverse beam-distribution measurements of high-current cw accelerators must be obtained from noninterceptive sensors. For the 100-mA H_3 or D beam of the Fusion Materials Irradiation Test (FMIT) accelerator, these transverse properties may be obtained by detecting the visible radiation resulting from beam interactions with residual gas. This report describes a new technique for sensing and digitizing the light projected transversely from the beam of the FMIT accelerator at Los Alamos National Laboratory. An input lens focuses the beam-profile image onto a bundle of optical fibers that are spatially coherent from end to end. The output end gathers the fibers from the four input legs into a small double-row format. Thus, four different beam-profile images are transferred from this fiber-optic bundle (Imagescope) through a microchannel-plate (MCP) image intensifier with a format arranged so that two linear photodiode arrays (Reticons) receive the intensified images. The photodiode arrays have 512 elements each; thus, each beam profile has a 256-element resolution. An electronic package accepts the electric signal from the photodiodes, digitizes the contribution of each sensitive element, and transmits the digitized profile informa-

tion over a fiber-optic data link to a memory unit accessible by the CAMAC data-acquisition and processing system. Details of this new beam-profile imaging and digitizing system are presented.

12581 **Proposal for an extra RF system dedicated to bunch length control and synchrotron movement stabilization.** Bergher, M. (Laboratoire pour l'Utilisation du Rayonnement Electromagnetique, 91405 Orsay Cedex). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 2242-2243(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

A gain limitation for the F.E.L. installed in ACO appears as the charge density decreases in connection with the "anomalous lengthening" and the synchrotron movement instabilities which are affecting high current operation of the storage ring. An extra RF system is designed to cure both these effects. The basic component of the system is an extra cavity driven through a power RF amplifier by a signal whose spectrum is composed by the even harmonics of the revolution frequency and the nf /SUB o/ - f /SUB s/ side bands. The proper input is achieved from the signal induced by the beam on a radial pick-up electrode by means of a pulsed window amplifier. The amplifier equalizes the two components of the picked-up signal, one due to energy oscillation and the other to phase oscillation and thus realizes the suitable spectrum for the input. A feedback loop ensures the normalization of that signal. Synchrotron movement stabilization and bunch length control are expected to work for stored currents up to 100 mA.

12582 **Low-noise gallium-arsenide field-effect transistor preamplifiers for stochastic beam cooling systems.** Leskovar, B.; Lo, C.C. (Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 2259-2261(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The present noise performance, bandwidth capability and gain stability of bipolar and field-effect transistors, parametric amplifier, Schottky diode mixer and maser are summarized and compared in the 100 MHz to 40 GHz frequency range for stochastic beam cooling systems. Stability factor of GaAs FET's as a function of ambient temperature is presented and discussed. Performance data of several low-noise wide-band cryogenically cooled preamplifiers are presented including one with a noise figure of 0.35 dB over a bandwidth range of 150500 MHz operating at ambient temperature of 20°K. Also, data are given on a broadband 1-2 GHz preamplifier having a noise figure of approximately 0.2 dB. The gain, operating noise temperature, stability, gain nonuniformity and phase-shift as function of frequency of interest for beam cooling systems are discussed.

12583 **Choice of focusing strength and aperture for high energy synchrotrons and colliders.** Teng, L.C. (Fermi Nat.'l Accelerator Lab., P.O. Box 500, Batavia, IL 60510). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 2576-2577(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

At low energies and low intensities the considerations in the choice of the focusing strength for a synchrotron are the beam size and the orbit distortion due to field errors which together generate a geometrical requirement on the size of the beam pipe and the good field aperture. The closed orbit distortion increases with focusing strength and was cited as the factor which counteracted the desire to reduce the beam size indefinitely by going to arbitrarily strong focusing. At high energies and intensities and with modern technology this is no longer true. The beam size is generally negligibly small and the orbit distortion can be corrected to arbitrarily desired accuracy. Studies of field errors and orbit distortions are now used for sizing the correction magnet system rather than the aperture. In high energy synchrotrons or colliders for which there is no geometrical demand on aperture, why, then, can one not apply arbitrarily strong focusing and use millimeter apertures for millimeter beams? The reason lies in the electromagnetic requirements which must be satisfied in order to stably transport a high current beam of whatever size through a conducting pipe. The beam current induces a voltage through the impedance of the beam pipe which can act back on the beam as positive feedback and make it unstable. The impedance depends and, therefore imposes demands on the material, the structure, the shape and the size of the beam pipe. In this paper the authors discuss these dependencies and complexities through the use of simplified semi-quantitative descriptions.

12584 **Stochastic cooling in the CERN ISR during p^-p colliding beam physics.** Peschardt, E.; Studer, M. (CERN, 1211 Geneva 23). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 2584-2586(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

When the ISR is used as a p^-p collider a high-intensity proton beam in R1 collides with a low-intensity antiproton beam in R2 for periods of up to two weeks. The luminosity lifetime is increased with a vertical stochastic cooling system in R1 designed for currents up to 10 A with a total bandwidth of 3.3 GHz. Cooling rates up to 0.7%/hr have been obtained. The R2 antiprotons are cooled vertically with a 100-600 MHz system which decreases the initial beam height by up to a factor of 7 and increases the luminosity by a factor of 1.3 to 1.4. A momentum cooling system in R2 (frequency range 55-155 MHz) creates empty space within the antiproton stacking aperture. This allows several stacks from the antiproton accumulator to be stored in the ISR. With this system which uses the Palmer method it has been proven experimentally that momentum cooling and horizontal betatron cooling are obtained simultaneously if the betatron phase between pick-up and exciter is an odd number of half-betatron wavelengths. The cooling rate of the momentum cooling system which is powerlimited is typically 4%/hr at 26 GeV/c. The layout of the cooling system is shown schematically. The position of the various elements is mainly determined by the available free space and the lattice parameters. Future applications include vertical cooling of antiprotons in all three planes in an experiment where a circulating 3.5-7.5 GeV/c antiproton beam collides with a hydrogen gas jet target.

12585 **Intermediate energy electron cooling for antiproton sources using a Pelletron accelerator.** Cline, D.B.; Adney, J.; Ferry, J.; Kells, W.; Larson, D.J.; Mills, F.E.; Sundquist, M. (Univ. of Wisconsin, Dept. of Physics, 1150 Univ. Ave., Madison, Wisconsin). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 2370-2372(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

It has been shown at FNAL that the electron cooling of protons is a very efficient method for reaching high luminosity in a proton beam. The emittance of the 120 KeV electron beam used at Fermilab corresponds to a cathode temperature of 0.1 eV. In order to apply cooling techniques to GeV proton beams the electron energies required are in the MeV range. In the experiment reported in this paper the emittance of a 3-MeV Pelletron electron accelerator was measured to determine that its emittance scaled to a value appropriate for electron cooling. The machine tested was jointly owned and operated by the University of California at Santa Barbara and National Electrostatics Corporation for research into free-electron lasers which also require low emittance beams for operation. This paper describes the thermal emittance of the beam to be the area in phase space in which 90% of the beam trajectories lie and goes on to describe the emittance-measurement method both in theory and application.

4303 Auxiliaries And Components

REFER ALSO TO CITATION(S) 12564, 12572, 12580, 13040

12586 **(AD-A—131681/9) Gain measurement on the aco storage ring. Interim report.** DeACOn, D.A.G.; Madey, J.M.J.; Robinson, K.E.; Bazin, C.; Billardon, M. (Stanford Univ., CA (USA). High-Energy Physics Lab.). Mar 1981. 7p. NTIS, PC A02/MF A01.

We report the results of the first gain measurements on the free electron laser being assembled on the storage ring ACO. The largest measured peak gain, averaged over the laser mode, is G = 4.3 x 10 to the -4 per pass. No laser induced bunch lengthening is observed within the experimental accuracy of 50 psec under a laser intensity of 1.6 kw/squared cm and under the conditions of strong anomalous bunch lengthening (ot/ot (I=O)) = 6.8 - 4.2.

12587 **(AD-A—132543/0) Study of thick-target x-ray spectra using photonuclear reactions. Doctoral thesis.** Prado, K.L. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA)). 1983. 234p. NTIS, PC A11/MF A01.

Megavoltage bremsstrahlung spectra which are produced in thick targets were investigated using photonuclear reactions. Ratios of photonuclear yields in teflon and in K2SiF6 were obtained that serve as sensitive indexes of thick target x-ray quality and endpoint energy in the energy range from about 14 to 30 MeV. Because thick target bremsstrahlung spectra have never before been used in the determination of photonuclear reaction cross sections, a numerical analysis computer calculation of thick target bremsstrahlung spectra was written to approximate the spectra of x-rays produced in thick targets of clinical electron linear accelerators and examine the feasibility of using such spectra for cross section determinations. The spectra obtained by computer simulation were used to calculate the photonuclear cross section of the 27 A1(gamma, 2p)Superscript 25Na reaction from 25 to 33 MeV. The calculated cross section is reported and is compared to a previously reported cross section and to a cross section calculated using thin target bremsstrahlung spectra. Analyses of the results obtained indicate that thick target x-ray spectra can be used for photonuclear reaction cross section determination.

12588 **(CONF-8309127—6) Some experiments with heavy ion accelerators.** Janssens, R.V.F. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 16p. NTIS, PC A02/MF A01. Order Number DE84005218.

From International Nuclear Target Society workshop; Argonne, IL, USA (7 Sep 1983).

Studies of nuclear structure at high angular momentum are currently one of the main research topics at the Argonne Superconducting Linac. Some of the techniques used in γ-ray spectroscopy are discussed. Target properties required for the experiments are reviewed. Some recent results are presented.

12589 **(FERMILAB/TM—1222) Brief summary of staffing levels at Fermilab during initial construction years.** Livdahl, P.V. (Fermi National Accelerator Lab., Batavia, IL (USA)). Nov 1983. Contract AC02-76CH03000. 15p. NTIS, PC A02/MF A01. Order Number DE84005821.

Portions are illegible in microfiche products.

This paper very briefly summarizes the work of the various groups that were involved from the beginning through the end of the initial construction phase of the Fermilab project (defined here to be July 1, 1972) and the final construction or completion phase which is here defined as December 31, 1973. The numbers in this report have been gathered by examining the personnel records of Fermilab with the research being done by Chuck Marofske, the Head of Laboratory Services and his staff and by assembling information from the memories of people still with the laboratory in 1983. Since there was much mobility within the laboratory during the construction years and frequent reorganizations were the norm, the numbers presented herein can not be considered to be more accurate than about +- 5%.

12590 **(FERMILAB/TM—1229) Neutron therapy facility at the Institute of High Energy Physics, Academia Sinica.** Zhu, Y.C. (Fermi National Accelerator Lab., Batavia, IL (USA)). Dec 1983. Contract AC02-76CH03000. 13p. NTIS, PC A02/MF A01. Order Number DE84005822.

Portions are illegible in microfiche products.

The 10 MeV proton linac which was designed as preinjector for the Beijing 50 GeV Proton Synchrotron (BPS) was completed by the end of 1982. Because of the economic readjustment in the People's Republic of China the BPS project was cancelled. Then, the Institute of High Energy Physics decided to increase the energy of the linac from 10 MeV to 35.5 MeV. This increase will take place using the primary five megawatts RF system of the 10 MeV linac. This 35.5 MeV proton linac will be used for research in radiomedicine and radiobiology in general and in particular for research in fast neutron therapy and radiopharmaceutical production. This project has been approved by the Academia Sinica.

12591 **(INS-R—303) Development of a tandem accelerator mass spectrometer at I.N.S.** Wallace, G.; Sparks, R.J.; More, R.D. (Department of Scientific and Industrial Research, Lower Hutt (New Zealand). Inst. of Nuclear Sciences). Apr 1982. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704335.

A 6MV tandem accelerator has been bought from Australian National University, and is currently being installed in New Zealand. It is intended that one of the main applications of the machine will be mass spectrometry of ^{14}C and other cosomogenically-produced isotopes. The proposed development of equipment to undertake this is reviewed.

12592 **(JINR-R—9-82-731) Electron ring fast extraction system at the JINR collective accelerator prototype.** Zhabitskij, V.M.; Ivanov, I.N.; Kaminskaya, A.M.; Kaminskij, A.K.; Sergeev, A.P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1982. 9p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704336.

The problem of choice of an electron ring fast extraction system at the model of collective accelerator has been considered. The fast extraction system provides the preset moment of electron rings extraction into a region of steep magnetic field which is formed by the adhezator compression stage coils and by the coils of accelerating section. The system consists of an additional single-winding coil creating a magnetic barrier that impedes a ring extraction and current generator providing current pulse of the required shape. Different variants of a fast extraction system have been discussed. The experimental results confirming the capability of the selected variant of a fast extraction system have been presented.

12593 **(LA—9878-MS) Beam transfer at LAMPF II.** Colton, E.P. (Los Alamos National Lab., NM (USA)). Nov 1983. Contract W-7405-ENG-36. 12p. NTIS, PC A02/MF A01. Order Number DE84006694.

The injection and extraction mechanisms for the LAMPF II rings are discussed. The designs refer to current five-sided machines designed and labeled LIIA19 and LIIS19. Extraction from LIIA19 and injection into LIIS19 are effected in a single turn using fast kickers and Lambertson septa. Storage ring extraction will be via half-integral resonant extraction and will utilize electrostatic and Lambertson extraction septa.

12594 **(LAL-RT—83-13) Sensitive beam profile monitor for emittance measurements.** Chehab, R.; Humbert, G.; Leblond, B. (Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire). Jul 1983. 4p. (CONF-830822—46). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750461.

From 12. international conference on high energy accelerators; Batavia, IL, USA (11 Aug 1983).

A beam profile monitor based on secondary emission phenomenon in porous dielectric layers is described. A Cs I layer with a thickness of 125 microns and a relative density 4% of the bulk density is obtained on a 4 cm diameter aluminium disk by evaporation of about one gram at 4 Torr Argon pressure. Observations on

density dependence on pressure, hygroscopy and velocity of deposition are reported. Integrated currents measured on 1 mm collector strips equally spaced 1 mm apart allow profile determination. A secondary emission coeffficient greater than 4 has been measured for a 25 MeV electron beam of $5x10^{-9}$ A mean current. Dependences of secondary yield on beam intensity and polarization voltage have been measured, as well as transient response for an uncharged layer. Transverse beam profiles have been measured and compared with other profile determinations. Good homogeneity and sensitivity make that type of a monitor interesting for low intensity beams, like positron linac beams, making it available for emittance measurements.

12595 **(RL—83-014) Design and calibration of precision drift chambers for use in a gluonium search experiment at the CERN ISR.** Albrow, M.G.; Beadle, N.J.; Carter, A.A. (Rutherford Appleton Lab., Chilton (UK)). Mar 1983. 31p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83704337.

The design, construction and calibration of a set of high precision drift chambers are described. The precise coordinate (σ is approximately equal to 120 μm) is determined by drift time measurement, with the orthogonal coordinate given by the charge division method (σ is approximately equal to 1.2 mm). The chambers have been calibrated using a well-defined laser beam. Their use within a gluonium search experiment at the CERN ISR is also described.

12596 **Longitudinal phase space matching between microtrons at 185 MeV.** Takeda, H. (Argonne Nat.'l Lab., Argonne, IL 60439). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2655-2657(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

Electrons are accelerated to 185 MeV by a microtron. Then they are injected into another microtron to boost the net energy up to a few GeV. Between the two microtrons both longitudinal and transverse phase space matching are required. In this paper, the authors consider a longitudinal phase ellipse matching which utilizes triple left-rightleft sector dipoles to induce a negative phase angle shear. This is accomplished because a high energy particle travels a shorter distance through the dipole system than a low energy particle.

12597 **Pulsed power supply system for the "fast" quadrupoles in the AGS.** Nawrocky, R.J.; Lambiase, R.F. (Accelerator Department, Brookhaven National Laboratory, Associated Universities, Inc. Upton, New York 11973). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2772-2774(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

In the acceleration of polarized protons in the AGS, a number of depolarizing resonances will be encountered. Depolarization due to the so-called intrinsic resonances will be minimized by crossing each resonance in less than one beam revolution period (about 2 μs). This will be accomplished with a set of twelve "fast" tune-shifting quadrupoles distributed symmetrically around the ring. During a typical acceleration cycle, the fast quads will be energized with a burst of alternating polarity, fast rise/slow fall triangular current pulses. The amplitude of these pulses will vary from 160 A to about 2700 A peak. This paper describes the development of the pulsed power supply for the fast quads, the construction of a prototype modulator and some of the initial test results obtained with the prototype.

12598 **Bunching system for the Stony Brook tandem linac heavy-ion accelerator.** Brennan, J.M.; Chen, C.E.; Noe, J.M.; Paul, P.; Scholldorf, A.; Sprouse, G.D. (Physics Dept., Suny-Stony Brook, Stony Brook, NY 11794). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2798-2800(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

A versatile high-efficiency bunching system which is used to couple the Stony Brook 9 MV tandem Van de Graaff to the recently completed superconducting heavy-ion LINAC is described. The major elements of the system are: a pre-tandem double-drift harmonic buncher working at 9.4 and 18.8 MHz, a post-tandem sine-wave beam chopper at 4.7 MHz, a pre-LINAC superconducting double-drift harmonic buncher at 150 and 300 MHz and a high voltage DC-coupled single pulse selecting beam switch.

12599 **Graphite targets at LAMPF.** Brown, R.D.; Grisham, D.L. (Los Alamos Nat.'l Lab., Los Alamos, NM 87545). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2801-2803(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

Rotating polycrystalline and stationary pyrolytic graphite target designs for the LAMPF experimental area are described. Examples of finite element calculations of temperatures and stresses are presented. Some results of a metallographic investigation of irradiated pyrolytic graphite target plates are included, together with a brief description of high temperature bearings for the rotating targets.

12600 **The Fermilab Tevatron-1 project target station for antiproton production.** Hojvat, C.; Bialles, G.; Hanson, R.; Heim, J.; Lange, F. (Fermi Nat.'l Accelerator Lab., Batavia, IL 60510). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2815-2817(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

Production of 8 GeV antiprotons in the Fermilab Tevatron I project will utilize 120 GeV protons from the Main Ring. The Target Station consists of an entrance collimator, the target itself, a pulsed lithium lens for p^- collection, a pulsed magnet for the separation of the 8 GeV secondaries, and a beam dump. These components are mounted on vertical modules within the Target Service Building. Allowance has been made for future improvements to increase the collected p^- flux. The design of the Target Station and its components is discussed.

12601 **Improved control system of the thyristor flicker suppressor for the KEK 12-GeV PS.** Matsumoto, S.; Baba, H.; Mikawa, K.; Sato, H.; Sueno, T. (Nat.'l Lab for High Energy Physics, Oho-machi, Tsukaba-gun, Ibaraki-ken, 305). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2932-2934(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

Thyristor control system of the 20 MVar flicker suppressor has been improved essentially. The previous feed forward (FF) loop with each single phase reactive current detector of the MR magnet power supply was exchanged to the present by both FF- and NFB-loops. The FF-loops consists of a three phase reactive power detector of the MPS and a forcing pattern generator on the fast but steady line voltage flicker, sag and surge. The NFB-loops control by the slow parts of the flicker and the unbalanced line voltages. These detectors of the reactive power, the voltage flicker and the unbalance have been developed. Sampled voltage flicker data with 12 bit ADC are processed by Z-80A micro computer system and the forcing pattern is generated by the system through 12 bit DAC into the loop. A typical voltage flicker including sag and surge has been reduced within + or - 1.5%, about 1/3 compared to the previous, at 66 kV primary line.

12602 **Pulsed air-core deflector-magnet design parameters.** Jason, A.J.; Blind, B.; Cooper, R.K.; Koelle, A.R.; Liebman, A.D. (AT-3, MS H808, Los Alamos Nat.'l Lab., Los Alamos, NM 87545). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2938-2940(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The response of air-core magnets to pulsed excitation is dependent on the pulse frequency spectrum because of fields produced by induced currents in the magnet structure. The authors discuss this phenomenon quantitatively in terms of magnet performance optimization.

12603 **A high precision waveform generator.** Rotolo, C.J. (Fermi Nat.'l Accelerator Lab., P.O. Box 500, Batavia, IL 60510). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2959-2961(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The microprocessor controlled waveform generator produces a piece-wise linear time dependent analog reference (+ or - 10 V /SUB FS/) for the Fermilab Saver Higher Order Correction Element power supplies.[1] Up to 32 major linear segments can be programmed with end point amplitude resolution of 305 /SIGMA PHI/V and time resolution of 6.5 ms. Major segments can be subdivided in up to 32 subsegments to achieve smoother slope transitions. The output of a high precision 16-bit D/A converter having 305 /SUB lv/ V steps is further smoothed with circuitry whose output is an analog integrator that follows the centerline of these steps. Typical ripple (smoothness) errors are such that $\Delta V/V$ /SUB FS/ $< 10^{-5}/f$, and for frequencies less than 1 KHz, output noise is less than 10 /SIGMA PHI/Vp-p. Typical DC linearity over a 25°C temperature range is + or -150 /SIGMA PHI/V. Measured gain errors were 0.7 PPM/°C and zero stability was 2 /sigma phi/V/ °C. The overall absolute accuracy of the generator is + or - 0.005% FS (+ or - 500 /sigma phi/V).

12604 **The FMIT accelerator.** Armstrong, D.D. (AT-4, MS H821, Los Alamos Nat.'l Lab., Los Alamos, NM 87545). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2965-2969(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

A 35-MeV 100-mA cw linear accelerator is being designed by Los Alamos for use in the Fusion Materials Irradiation Test (FMIT) Facility. Essential to this program is the design, construction, and evaluation of performance of the accelerator's injector, low-energy beam transport, and radio-frequency quadrupole sections before they are shipped to the facility site. The installation and testing of some of these sections have begun as well as the testing of the rf, noninterceptive beam diagnostics, computer control, dc power, and vacuum systems. An overview of the accelerator systems and the performance to date is given.

12605 **4 π-mode acceleration in KEK 20-MeV proton linac.** Takasaki, E.; Fukumoto, S.; Kato, T.; Kubota, C.; Lgarashi, Z.; Lkegami, K.; Mori, Y.; Tagaki, A.; Takenaka, T. (Nat.'l Lab. for High Energy Physics, Oho-machi, Tsukubagun, Ibaraki-ken, 305). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 3036-3038(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

Ions of H^+_2 and He^{2+} were accelerated by 4π-mode operation in the KEK 20 MeV proton linear accelerator. In this mode the same accelerating field distribution and the same focusing magnetic field strength as those for protons were used. This paper gives the experimental results of the relation between the injection energy and the accelerating field strength and of the beam intensity as a function of the field strength.

12606 **Improved performance of the Munich heavy ion postaccelerator.** Nolte, E.; Gartner, N.; Geier, R.; Gustavsson, S.; Morinaga, H.; Ratzinger, U.; Schollmeier, W. (Fachbereich Physik, E17, Techn. Universitat Munchen). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2983-2985(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

Improvements of the shunt impedance and of the phase acceptance of the Munich heavy ion postaccelerator are described. The shunt impedance has been increased by using slimmer drift tubes, by mounting more drift tubes and by installing a drift tube configuration with flat gap voltage distribution along the resonator axis. The phase acceptance has been increased by means of a three-harmonics double-drift buncher on the high-energy side of the tandem. The phase acceptance of the system buncher booster is about 70%.

12607 **Recent experience with antiproton cooling.** Carron, G.; van der Meer, S.; Johnson, R.; Taylor, C.; Thorndahl, L. (CERN, 1211 Geneva 23). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2587-2589(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

Improvement of transverse stochastic cooling in cases where the pick-up-to-kicker distance is not optimal may be obtained by using a transmission-line filter that causes opposite phase shift at alternating Schottky sidebands. Improvement of the horizontal stack-core cooling in the Antiproton Accumulator by using a pickup at a zero dispersion location is planned; the filter technique will make this possible. The improvement of the signal-to-noise ratio in the 250-500 MHz stack tail termination resistors is discussed, as well as some problems caused by undesired modes perturbing the pickup response.

12608 **Matching an isochronous cyclotron to a synchrotron to provide a high intensity injector.** Laxdal, R.; Craddock, M.K.; Joho, W.; Mackenzie, G.H.; Richardson, J.R.; Teng, L.C. (TRIUMF, 4004 Wesbrook Mall, Vancouver, B.C., V6T 2A3). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2013-2015(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

Schemes are described for injecting the 23 MHz cw H^- beam from the TRIUMF 500 MeV cyclotron efficiently into a 30 Hz rapid-cycling synchrotron. The authors have considered extraction of 100-200 turn pulses from TRIUMF followed by multiturn injection into a dc accumulator ring mounted in the synchrotron tunnel. An alternative is to build a small isochronous storage ring to compact several thousand turns. Computer simulations of the various extraction processes are presented.

12609 **Water-cooled target box design at LAMPF.** Grisham, D.; Lambert, J. (Los Alamos Nat.'l Lab., Los Alamos, NM 87545). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2270-2272(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The target boxes in the main experimental beam line (Line A) at the Clinton P. Anderson Meson Physics Facility (LAMPF) have operated since 1976. A program of replacing the boxes is underway. This paper presents past history, design considerations, calculational results and the final box design.

12610 **Accelerator controls at DESY.** Peters, F. (Machine Control Group (MKR/F58), Deutsches Elektronen-Synchrotron DESY, Notkestrasse 85, D-2000 Hamburg 52). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2299-2301(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

Six e^+ e^- accelerators are working at DESY. All of them are operated from one central control room via the new common control system. The report describes some design aspects, system structure, first experience, and the control room.

12611 **Computer controlled vacuum control system for synchrotron radiation beam lines.** Goldberg, S.M.; Wang, C.; Yang, J. (Stanford Synchrotron Radiation Laboratory, SLAC Bin-69, P.O. Box 4349, Stanford, CA 94305). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 2362-2363(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The increasing number and complexity of vacuum control systems at the Stanford Synchrotron Radiation Laboratory has resulted in the need to computerize its operations in order to lower costs and increase efficiency of operation. Status signals are transmitted through digital and analog serial data links which use microprocessors to monitor vacuum status continuously. Each microprocessor has a unique address and up to 256 can be connected to the host computer over a single RS232 data line. A FORTRAN program on the host computer will request status messages and send control messages via only one RS232 line per beam line, signal the operator when a fault condition occurs, take automatic corrective actions, warn of impending valve failure, and keep a running log of all changes in vacuum status for later recall. Wiring costs are thus greatly reduced and more status conditions can be monitored without adding excessively to the complexity of the system. Operators can then obtain status reports at various locations in the lab quickly without having to read a large number of meter and LED's.

12612 **Control of machine functions or transport systems.** Woodley, M.D.; Jager, J.; King, A.S.; Lee, M.J. (Stanford Linear Accelerator Ctr., Stanford Univ., Stanford, CA 94305). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 2367-2369(Aug 1983). (CONF-830311—). Contract AC03-76SF00515.

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

A computer code, COMFORT, has been developed at SLAC for on-line calculation of the strengths of magnetic elements in an electron storage ring or transport beam line, subject to first order fitting constraints on the ring or beam line parameters. This code can also be used off-line as an interactive lattice or beam line design tool.

12613 **Transverse instabilities in the Daresbury SRS.** Jackson, A.; Marks, N.; Poole, M.W.; Saxon, G.; Suller, V.P.; Walker, R.P. (SERC, Daresbury Lab., Daresbury, Warrington WA4 4AD). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 2522-2524(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

Transverse instabilities can limit the achievable beam current in the SRS storage ring both in the single bunch mode and in the multibunch mode. It is shown that these instabilities originate in higher order modes in the accelerating cavities. The threshold of these instabilities can be greatly increased by the use of octupole fields.

12614 **An RF separator for cloud muons at TRIUMF.** Macdonald, J.A.; Blackmore, E.W.; Bryman, D.A.; Doornbos, J.; Erdman, K.L.; Pearce, R.M.; Poirier, R.L.; Poutissou, J.M.; Spuller, J. (TRIUMF, 4004 Westbrook Mall, Vancouver, B.C., V6T 2A3). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 2833-2835(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

A particle separator utilizing a magnetic field crossed with an rf electric field has been built and incorporated into the M9 secondary channel to produce a clean negative muon beam at 77 MeV/c + or - 5%. The separator is driven at the main cyclotron frequency (23 MHz) and phase locked to the primary proton beam. Separation is achieved by using both the temporal and velocity differences between the muons, produced near the production target (cloud muons), and both the pion and electron contaminants in the beam.

12615 **An adiabatic matching device for the Orsay linear positron accelerator.** Chehab, R.; Le Meur, G.; Mouton, B.; Renard, M. (Laboratoire de l'Accelerateur Lineaire, Universite de Paris-Sud, 91405 Orsay). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 2850-2852(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

An adiabatically tapered solenoidal magnetic field is used to match positron beam source emittance to accelerating section acceptance. Such a matching system improves the accepted energy band which has been accurately computed and compared with analytical determination. The tapered field is provided by stacked pancakes and solenoids of various radii; total lens length is about 0.75m. The adiabatic matching system took the place of a quarter wave transformer system and has been in operation for two years. Positron conversion ratio is 3.3% for a 1 GeV incident electron beam and presents a factor of nearly two of improvement for the positron yield. Energy bandwidth of positron beam has also been increased by a factor of nearly 2.5; the output positron beam energy is of 1.2 GeV.

12616 **Performance of the new cryogenic vacuum system at the Bevatron.** Avery, R.T.; Alonso, J.R.; Henderson, T.F.; Kennedy, K.D.; Meneghetti, J.R. (Lawrence Berkeley Lab., Univ. of Calif., Berkeley, CA 94720). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 2895-2897(Aug 1983). (CONF-830311—). Contract AC03-76SF00098.

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

A cryogenically cooled liner has been installed within the Bevatron to achieve 10^{-10} Torr vacuum. Features and performance of this liner are described including achieved pressures, residual gas composition, cryo heat loads, leak rates through moving and static seals, and cool-down and warm-up times.

12617 **Oxygen deficiency hazard induced by helium release in accelerator tunnel.** Brown, D.P.; Sondericker, J.H. (Brookhaven Nat.'l Lab., Upton, NY 11973). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 2898-2900(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

Tests to investigate oxygen deficiency levels due to release of helium into the CBA tunnel are described. Results of the tests indicate that the helium stratifies and spreads quickly in the horizontal plane. This demonstrates that adequate warning of possible asphyxiation hazards can be achieved. When oxygen deficiency monitors are located at ceiling level they may be spaced at intervals of 60 m. or more and still achieve acceptable results.

12618 **A bipolar, high precision, low ripple power supply.** Pfeffer, H.; Yarema, R.J. (Fermi Nat.'l Accelerator Lab., P.O. Box 500, Batavia, IL 60510). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 2870-2872(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

A + or - 600 V, + or - 50 Amp high precision SCR power supply has been developed for use in the Energy Doubler Correction system. The bipolar output is accomplished by means of a dual converter with circulating current for smooth zero-crossing current transitions. Absolute accuracy better than + or - .025% is achieved with a high precision transductor, current reference, and other high quality components. Stability is better than 2.5 ppm/°C and voltage ripple is less than 30 mV peak to peak. Low ripple is achieved through the use of bipolar series-pass transistor bank. The dual converter (plus a passive filter) acts as a pre-regulator for the transistor bank, which has a dynamic range of 30 volts. Ripple attenuation of the transistor bank is a minimum of 60 dB from DC to 2 kHz. Microvolt level noise and pickup in the power supply regulator ultimately set the ripple level in the power supply output. A special

"active ground" circuit is included to filter the common mode ripple which is inherent in SCR supplies.

12619 **Dual frequency ring magnet power supply with a flat-bottom.** Praeg, W.F. (Argonne Nat.'l Lab., Argonne, Illinois). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 2873-2875(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

A power supply is described that furnishes an essentially flat-bottom injection field, followed by a dual frequency cosine field. This results in efficient beam capture during injection and reduces significantly the peak rf power required during acceleration in a rapid-cycling synchrotron.

12620 **Computer modeling of the klystron.** Tallerico, P.J.; Carlsten, B.E. (Los Alamos Nat.'l Lab, Los Alamos, NM 87545). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 2170-2172(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

Although the klystron was invented over 40 years ago, it still is quite a scientific challenge to analyze this seemingly simple device. Accurate calculation of space-charge density and particle motions are required, but there are dozens of parameters that must be optimized. Thus the analysis must be inexpensive to run, because over 100 runs typically are required to optimize a particular design. A self-consistent ring model of the klystron interaction is being developed for use as a design tool, with the initial goal of improving the LAMPF klystrons to conserve electrical energy. A mathematical model that includes large signal effects, relativity, harmonic and fundamental cavities, extended cavity fields, and self-consistent calculations of the induced currents is being developed. The model is self-consistent because the gap fields are calculated interactively, because the currents that drive the cavities are not known until after the beam transverses the cavities. Several test cases have been run, and the basic theory and results to date are discussed.

12621 **Reducing ferrite tuner power loss by bias field rotation.** Smythe, W.R. (Nuclear Physics Lab., Univ. of Colorado, Boulder, CO 80309). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 2173-2175(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

It has been suggested that ferrite tuners for rf cavities with the magnetic bias field perpendicular to the rf magnetic field would have greatly reduced rf losses. Recent measurements at Los Alamos National Laboratory appear to confirm this effect. A simple model proposed here allows the calculation of tuning characteristics for a variety of bias schemes. The model shows that the perpendicular bias scheme mentioned above requires very much larger bias levels than does the parallel bias scheme in order to achieve the same tuning range with a particular ferrite tuner. However, further investigation with the model has led to the discovery that the use of perpendicular bias at low frequency and parallel bias at high frequency requires only a modest increase in the bias field. In effect, the ferrite is kept highly magnetized, reducing ferrite losses, and is tuned primarily by rotating the bias field direction with respect to the rf field direction. The resulting reduction in dissipation can significantly reduce the amount of ferrite required per cavity.

12622 **Polarimeters for the AGS polarized proton beam.** Crabb, D.G.; Bonner, B.; Buchanan, J.; Bywater, J.A.; Cameron, P.R.; Fujisaki, M.; Linn, S.L.; Perlmutter, A.; Rice, J.; Roberts, J.B. (Accelerator Department, Brookhaven National Laboratory, Associated Universities, Inc., Upton, New York 11973). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 2176-2178(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

This report describes the three polarimeters which will be used to measure the beam polarization at the AGS polarized beam facility. The beam polarization will be measured before injection into the AGS, during acceleration, and after extraction from the AGS. The 200 MeV polarimeter uses scintillation counter telescopes to measure the asymmetry in p-carbon inclusive scattering. The internal polarimeter can measure the beam polarization at up to five selected times during acceleration. A continuously spooled nylon filament is swung into the beam at the appropriate time and the asymmetry in pp elastic scattering measured by two scintillation counter telescopes. This is a relative polarimeter which can be calibrated by the absolute external polarimeter located in the "D" extracted beam line. This polarimeter uses scintillation counters in two double-arm magnetic spectrometers to measure clearly the asymmetry in pp elastic scattering from a liquid hydrogen target. The specific features and operation of each polarimeter are discussed.

12623 **Microprocessor techniques and construction at the NSLS.** Klein, J.D.; Sheehan, J.F. (Nat.'l Synchrotron Light Source, Brookhaven Nat.'l Lab., Upton, NY 11973). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 2222-2224(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

A description is given of the microprocessor systems in use at the NSLS, which utilize Intel Multibus and NSLS-developed printed circuit boards. Ease of manufacturing and flexibility of developing different systems from a set of NSLS standard components is emphasized, and the low cost factors of each system and the utilization of off-the-shelf components will be indicated.

12624 **Improving the phase stability of the Slac RF driveline network for SLC operation.** Weaver, J.N.; Hogg, H.A. (Stanford Linear Accelerator Center, Stanford Univ., Stanford, CA 94305). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 2234-2236(Aug 1983). (CONF-830311—). Contract AC03-76SF00515.

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

Successful operation of the Stanford Linear Collider (SLC) will require greater phase stability from the two-mile long RF drive network than previous linac operation did. This paper discusses four proposed modifications of the present system that should help achieve the general objective to reduce all long term temperature and atmospheric pressure induced phase variations to less than 20° at 2856 MHz, so that the phase/amplitude detector subsystems, which will control the network output phases relative to a beam reference, will operate within their most accurate ranges.

12625 **Prototype phase and amplitude feedback-control systems for the FMIT accelerator.** Fazio, M.V.; Patton, R.D. (Los Alamos Nat.'l Lab., Los Alamos, NM 87545). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 2253-2255(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The phase and amplitude feedback-control systems for the Fusion Materials Irradiation Test (FMIT) accelerator have been successfully prototyped and tested. The testing was performed at low power with two 100-W rf systems driving a high-Q resonant cavity at 80 MHz. The control systems can maintain the cavity field amplitude to within + or - 1% and the phase to within + or - 1° of the set-point values. When there are multiple rf systems independently driving a resonant cavity through individual drive loops, amplitude matching and proper phasing between the outputs of each rf system are essential for proper system operation. Experimental results are presented.

12626 **Wide-bandwidth test fixture for electromagnetic beam sensors.** Gilpatrick, J.D.; Chamberlin, D.D.; Hahn, J.; Sherwood, B.A. (Los Alamos Nat.'l Lab., Los Alamos, NM 87545). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 2256-2258(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The Fusion Materials Irradiation Test (FMIT) accelerator will provide an intense deuteron beam at 35 MeV ($\beta \simeq 0.19$). The beam, following a stripping reaction on a lithium target, will supply the neutron flux required for studying materials that may be used in a fusion environment. The diagnostic measurement instrumentation, which will characterize the accelerator beam, must be noninterceptive because of the beam's power density. Instrumentation also must be fully functional for start up of the FMIT accelerator. To this end, a test facility was needed to examine signals from diagnostic probes that sense electromagnetic fields emanating from the charged particle beam. The test facility also will help evaluate the probes' corresponding measurement systems before final assembly into the beamline. Three types of test facility were proposed: a low-energy electron accelerator, a large "electron-gun assembly," and a coaxial structure that produces electromagnetic fields similar to that of the proposed FMIT accelerator. The third type was chosen because the design and fabrication could be done at Los Alamos and would be less costly. The coaxial structure can carry the impulse currents required but cannot model the FMIT accelerator charged-particle bunch velocities accurately. However, one may introduce a highly resistive dielectric material into the coaxial test fixture so that its electromagnetic-wave velocities match those of the accelerator's particle-bunch velocities. This paper describes the design and some experimental results of the coaxial test fixture.

12627 **Initial operation of E.C.R. ion sources with CYCLONE.** Jongen, Y.; Ryckewaert, G. (Laboratoire du Cyclotron, 2, Chemin du Cyclotron B - 1348, Louvain-la-Neuve). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 2685-2689(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

Two heavy ion sources, using the Electron Cyclotron Resonance have been realized in Louvain-la-Neuve. They use a superconducting magnetic structure to confine the plasma. The operational characteristics are explained and present results are shown. Produced beams include fully stripped N, C and O, Ne^{9+} and Ar^{16+}. The source has been used as injector for CYCLONE and was found stable, reliable and easy to operate.

12628 **Prototype sector magnets for the GeV electron microtron (GEM).** Wehrle, R.B.; Norem, J.H.; Praeg, W.F.; Swanstrom, R.H.; Thompson, K.M. (Argonne Nat.'l Lab., Argonne, IL 60439). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 2859-2861(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

Three prototypes of the sector magnets for GeV Electron Microtron accelerators have been designed. One has been built and two are under construction. The first is a full-scale 168-ton prototype for one-half of a 2 GeV Double Sided Microtron sector magnet. The successful fabrication and testing of the pole pieces for this prototype have demonstrated that their required close tolerances for flatness and parallelism can be met. The second magnet is an approximate two-thirds scale model of one step at the low energy end of the hexatron sector magnet designed for the 4 GeV Electron Microtron. The measured fields demonstrate that the field falls off faster than an "Enge-short-tail" and that error fields are at low levels and are controllable. A third prototype magnet exactly duplicates the full scale geometry of the first three full orbits of the 4 GeV Electron Microtron sector magnet from entrance to exit points. It will permit high precision measurements and corrections of field errors and verify the 3-dimensional computer program TOSCA.

12629 **Long distance wideband optical fiber links for accelerator synchronization.** Beger, H.H.; Boussard, D. (European Org. for Nuclear Research (CERN), Geneva). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 2152-2154(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The proper performance of a large-scale accelerator complex like the CERN network requires the transmission, over large distances, of precise timing pulses. The classical solution, which uses coaxial cables, increases both in difficulty and cost as the frequency and length of the link increase. In this context the use of optical fibers as a transmission media offers an attractive alternative. Such a link was installed in 1978 between the CERN SPS and its injector for the purpose of synchronizing the two machines. This paper reports on the technical performance of this link in terms of frequency response, signal to noise ratio, and long term stability. The link has two channels; one is used to transmit the SPS revolution frequency pulses and the other carries the SPS reference RF frequency at injection. At the PS receiving end the revolution frequency pulses are resynchronized with the transmitted RF frequency in order to achieve the best time accuracy. The two channels are identical and can be easily interchanged. The connecting cable, manufactured by Siecor, is installed over most of its 4 km length in underground plastic tubes. The fibers are made by Corning. The transmission system is a commercial module from General Optronics and contains a Ga As/Ga A1 As laser diode which, compared to a light emitting diode, provides a higher optical power, a faster speed and a much better spectral purity. The receivers are built around avalanche photodiodes from RCA. Temperature compensation and diode protection are provided. The preamplifiers have been designed to match the transmitted signals.

12630 **A single bunch transfer system for the National Synchrotron Light Source.** Sheehan, J.; Rambo, W.; Singh, O. (Nat.'l Synchrotron Light Source, Brookhaven Nat.'l Lab., Upton, NY 11973). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 2225-2227(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The accelerator system at the National Synchrotron Light Source consists of an S band 85 MEV linac and three synchrotron rings. The electron beam from the linac is accelerated by the booster ring to 600 MEV and transferred to one of the two storage rings. The smaller of the two rings operates at between 300 and 800 MEV and emits photons in the vacuum ultraviolet (VUV) while the larger storage ring operates at up to 2.5 GEV and emits photons in the x-ray spectrum. This report presents a system for loading the storage rings by filling a single phase space bunch in the booster ring and transferring it at the end of each booster cycle into a selected bucket in one of the storage rings. By controlling the timing of the transfer on successive transfer cycles, many fill positions may be obtained. This report describes the limitations of the original multibunch transfer method which led to the change in the injection system, gives the rationale for the transfer timing method which was subsequently derived, and discusses in detail the new transfer timing system. The prototype of such a system was installed at the National Synchrotron Light Source to perform synchronous transfer by controlling the time when the electron beam is injected and ejected in the booster ring.

12631 **Reduction of the apparent impedance of wide band accelerating cavities by RF feedback.** Boussard, D.; Lambert, G. (European Org. for Nuclear Research (CERN), Geneva). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 2239-2241(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

In the CERN SPS proton synchrotron the four accelerating cavities are of the travelling wave structure type. At the 10 GeV/c injection energy the cavities present to the beam an impedance very similar to that of a detuned RLC cavity with the result that strong dipole and quadrupole instabilities occur. The SPS accelerated beam current was limited by the combined action of these two effects to 2.5×10^{13} protons which resulted in capture losses increasing with the injected beam intensity. Among the solutions possible for this problem, the RF feedback, which would alleviate both transient beam loading and instability effects, looked to the authors to be the most promising. In such a system the total voltage seen by the beam is reinjected into the feedback cavity via its power amplifier. Without any delay in the system the cavity impedance seen

by the beam could be greatly reduced. Unfortunately the long delay in the system severely limits the bandwidth and the RF feedback could hardly correct more than the n = O beam loading component. The authors circumvented this problem by observing that they needed a large gain only in the vicinities of the RF frequencies. Outside these bands the phase rotation due to the long delay is unimportant if the gain is made low enough. If, in addition, the total delay of the system is made exactly equal to one machine turn, the open loop phase of the feedback system is always zero for each RF frequency. The two ingredients needed to make the RF feedback work for n not too small are therefore a transfer function with comb filter shape and a total delay of one machine turn. In this paper these ingredients are derived.

12632 **Signal suppression analysis for the momentum stochastic cooling with a multiple system.** Ruggiero, A.G. (Fermilab, P.O. Box 500, Batavia, IL 60510). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 2596-2598(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The Tevatron I project at Fermilab depends critically on the momentum stochastic cooling to collect and store antiprotons produced by injecting protons on a target. This project differs from the similar original project at CERN by the fact that it requires greater antiproton flux. Moreover, the stochastic cooling design is made of several systems each with its own pickup, kickers, and chain of amplification. These systems could overlap in the frequency bandwidth as well as in the beam response dynamics. It has been argued, consequently, that the performance of the momentum cooling might have been limited by the signal suppression which one derives when examining the cooling system in closed loop. In this paper an analysis is made of the closed loop system for momentum stochastic cooling. In the closed loop configuration the electronic feedback depends not only on the electronic component characteristics but also on the beam intensity and energy distribution. The results give the interrelation between the signals from the different parts of the system and their mutual enhancement or suppression. The paper goes on to derive the Vlasov equation, to calculate the perturbation force, and to solve a larger number of dispersion relations.

12633 **Momentum precooling in the debuncher ring for the Fermilab Tevatron I project.** Ruggiero, A.G.; Simpson, J. (Fermi Nat.'l Accelerator Lab., P.O. Box 500, Batavia, IL 60510). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 2599-2600(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The design of the antiproton source for the Fermilab Tevatron I project incorporates two separate rings. The Accumulator Ring uses a stochastic cooling/stacking system to accumulate a sufficient number of antiprotons for use in the collider; the Debuncher Ring rotates buckets and debunches antiproton pulses from the production target. This requires, in the Debuncher, a choice of lattice transition energy very near the beam energy, resulting in a very narrow spread in the circulation frequency. If the energy spread could be further reduced in the Debuncher before the beam is transferred to the Accumulator, operational improvements would result in the reduction of stochastic cooling power in the Accumulator, the acceptance of a larger momentum bite of antiprotons in the Debuncher, and the reduction of momentum aperture in the Accumulator. On the other hand, the small value of the dispersion in revolution frequency with the particle momentum places severe performance criteria on the depth and frequency of a notch filter used in a stochastic momentum precooling system. This paper describes a quick investigation of the feasibility of precooling within the framework of technically achievable parameters.

12634 **Effects of RF stacking on cooling tail in the Fermilab antiproton accumulator.** Ando, A.; Takayama, K. (Fermilab, P.O. Box 500, Batavia, IL 60510). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 2601-2603(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The scheme has recently been proposed to produce a high-intensity antiproton beam in a stochastic cooling accelerator. This beam is to be bunched adiabatically, decelerated, and then allowed to debunch adiabatically. At this point the beam is ready for stochastic cooling. It is soon moved down in the stream by the tail cooling system in order to make room for the next stacked beam. There are in general two effects that RF stacking gives an already stacked beam or "tail". The first and larger is phase-displacement acceleration and the second is so-called dilution coming from a non-adiabatic change of RF parameters which is understood to be enhanced by the non-linearity of RF stacking dynamics. In this paper both effects are discussed from a phase dynamical point of view. The dynamics of tail cooling are then discussed with the help of the Fokker-Planck equation. From the tail cooling point of view, the effects of RF stacking can be regarded as the deformation of the tail occurring within a limited period, as tail cutting due to phase displacement, and as non-uniform dilution in the tail due to non-adiabatic diffusion. An easy method for estimating beam loss due to phase displacement is prescnted and used to obtain the criteria which should be imposed on the cooling system.

12635 **Acceleration of heavy ions in the AGS.** Barton, M.Q. (Brookhaven Nat.'l Lab., Upton, New York 11973). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, vp(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

It is possible to use the Brookhaven AGS as a heavy ion machine by adding a cyclotron to the Tandem and using this combination as an injector. An intermediate step for lighter ions might consist of injecting the Tandem beam directly into the AGS. In either case it seems that quite high intensities are possible. For the past several years the Brookhaven Nuclear Physics Group has considered the possibility of adding a cyclotron to the present Tandem accelerator. As part of the proposal submitted last year to the funding agency it was shown that this Tandem cyclotron combination forms a quite suitable and realistic injector for the AGS. This paper discusses the theory and technology behind such a combination and provides the arguments by which its performance can be estimated.

12636 **A proposed second harmonic acceleration system for the Intense Pulsed Neutron Source Rapid Cycling Synchrotron.** Norem, J.; Brandeberry, F.; Rauchas, A. (Argonne Nat.'l Lab., Argonne, IL 60439). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 3490-3492(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The Rapid Cycling Synchrotron (RCS) of the Intense Pulsed Neutron Source (IPNS) operating at Argonne National Laboratory is presently producing intensities of 2-2.5 x 10^{13} protons per pulse (ppp) with the addition of a new ion source. This intensity is close to the space charge limit of the machine, estimated at about 3 x 10^{13} ppp, depending somewhat on the available aperture. With the present good performance in mind, accelerator improvements are being directed at increasing beam intensities for neutron science, lowering acceleration losses to minimize activation, and gaining better control of the beam so that losses can be made to occur when and where they can be most easily controlled. On the basis of preliminary measurements, the authors are now proposing a third cavity for the RF system which would provide control of the longitudinal bunch shape during the cycle which would permit raising the effective space charge limit of the accelerator and reducing losses.

12637 **A second harmonic (6-16 MHZ) rf system with feedback-reduced gap impedance for accelerating flat-topped bunches in the CERN PS booster.** Baillod, J.M.; Magnani, L.; Nassibian, G.; Pedersen, F.; Weissflog, W. (CERN, 1211 Geneva 23). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 3499-3501(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

Since all experimental and theoretical evidence indicates that the beam intensity in the PSB is at present limited by the Laslett Q shift after trapping, a second harmonic accelerating system is being added with the aim of producing flat-topped bunches. Calculations indicate that the resulting improvement in bunching factor should permit an intensity increase of 25 to 40%. Additionally, the bucket area is increased by 25 to 45% depending on intensity. A general description of the new cavities, which operate over a frequency range of 6-16 MHz with a maximum gap voltage of 8 kV, is given together with a description of associated power amplifiers and low level electronics. A notable feature is the use of a fast feedback system to reduce the gap impedance seen by the beam by an order of magnitude, incorporating a 130 W wide-band transistor amplifier with a total delay of about 5 ns. Initial performance with beam of the first system installed confirms theoretical expectations in terms of bunching factor and increased intensity limit. An expected improvement in beam stabilization by Landau damping from the strongly non-linear accelerating wave shape did not occur; on the contrary, Landau damping is lost even at low intensities, and harmful longitudinal bunched-beam modes of orders as high as sextupole (m = 3) and decapole (m = 5) have been observed and partly cured.

12638 **Comparison between solid graphite and graphite cloth as a target backing material for an ISOL system.** Schmid, M. (Brookhaven National Lab., Upton, NY); Gill, R.L.; Chung, C. *Nuclear Instruments and Methods in Physics Research;* **211**: No. 2/3, 287-291(15 Jun 1983).

A high temperature target-ion source system developed for the TRISTAN on-line isotope separator at Brookhaven National Laboratory is described. The system consists of a surface ionization chamber with a Re surface and ^{235}U in a graphic target matrix. Both solid graphite and graphite cloth targets were tested. The overall separation efficiencies for isotopes of Rb, Cs, Sr, Ba, In, Ce, Pr, Nd and Pm which were extracted directly from the ion source were measured. Production rates were measured as a function of temperature up to 2000°C and the ion source performance was monitored over long periods of time. The performance of solid graphite targets was found to give superior stable operation with no deterioration in production rates for operation times of up to 2000 h. In contrast, graphite cloth targets exhibited deterioration in efficiency with time for most elements with differing rates. The production rates of Ce and Pr isotopes increases significantly during the first 400 h of operation, followed by a slow decrease.

12639 **Calculation of the ORELA neutron moderator spectrum and resolution function.** Coceva, C. (Nuclear Energy Agency, Bologna, Italy); Simonini, R.; Olsen, D.K. *Nuclear Instruments and Methods in Physics Research;* **211**: No. 2/3, 459-467(15 Jun 1983).

The yield, spectrum, and delay-time distributions (resolution function) of escape neutrons from the ORELA water-moderated and water-cooled tantalum target assembly are calculated using time-dependent, three-dimensional Monte Carlo techniques. The resulting spectrum and delay-time distributions of the moderated neutrons are compared with measured values.

4304 Storage Rings

REFER ALSO TO CITATION(S) 12567, 12570, 12586

12640 (JINR-D—1,2-82-27, pp 320-325) **New Double Siberian Snake scheme with radiative polarizaition for LEP.** Steffen, K. 1982. NTIS (US Sales Only), PC A15/MF A01. (CONF-811147—).

From International symposium on polarization phenomena at high energies; Dubna, USSR (17 Nov 1981).

A new Double Siberian Snake scheme with radiative polarization for LEP is proposed. Radiative polarization of both signs is provided in the energy range between 45 GeV and 85 GeV. A Siberian Snake is a sequence of magnets that effects a 180 deg spin rotation about a horizontal axis. In the Siberian Snake of the 1 st kind, the spin is rotated about the longitudinal s-axis, while in the Snake of the 2 nd kind it is rotated about the transverse radial x-axis. It is shown that snakes and wigglers can be installed into LEP at a later stage without changes in the ring geometry. Practical recommendations are given.

12641 **(LAL-RT—83-10) Systematic study of a continuous family of rotators for HERA.** Buon, J. (Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire). Jun 1983. 13p. (CONF-8306156—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750460.

From Workshop on experimentation at HERA; Amsterdam, Netherlands (9 Jun 1983).

Rotators made of the three horizontally bending magnets interspaced with three vertically bending magnets are analytically studied. Short rotators with small depolarisation, small tune shift and small off-energy correction are searched for HERA.

12642 **(LAL-RT—83-11) Improved analytical method for studying beam-beam driven non-linear resonances.** Bambade, P. (Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire). Aug 1983. 4p. (CONF-830822—45). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750459.

From 12. international conference on high energy accelerators; Batavia, IL, USA (11 Aug 1983).

A compact averaging procedure is worked out to study the beam-beam effect in storage rings, in the weak beam-strong beam case. In order to avoid difficulties with polynomial approximations beam-beam potential deriving from the assumed Gaussian charge distribution is used.

12643 **(LAL-RT—83-12) Suppression of depolarisation by bean-beam interaction in an electron ring.** Buon, J. (Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire). Jul 1983. 4p. (CONF-830822—47). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750462.

From 12. international conference on high energy accelerators; Batavia, IL, USA (11 Aug 1983).

It is shown that depolarisation due to beam-beam interaction can be almost suppressed in an electron storage ring. The necessary "spin matching" conditions to be fulfilled are derived. They depend on the ring optics, assumed linear, but not on the features of the beam-beam force, like intensity and non-linearity.

12644 **Calibration of the ring model for the NSLS rings.** Bozoki, E. (National Synchrotron Light Source, Brookhaven National Laboratory, Upton, NY 11973). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2219-2221(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The mathematical model of an accelerator can be used to control its operation and also to simulate its behavior. Part of the model is the conversion between the computer controlled digital setpoints of the magnets and the actual field acting on the average particle in the magnet. The authors are using tune, dispersion and chromaticity measurements to calculate this conversion, thus calibrating the model rather than the magnets themselves. This is one way to include effects, not taken directly into account in the model. The model has to be calibrated at different beam momenta, and possibly at different beam intensities.

12645 **Synchrotron oscillations with very small /eta/.** Ando, A.; Takayama, K. (Fermilab, P.O. Box 500, Batavia, IL 60510). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-30**: No. 4, 2604-2606(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

Synchrotron oscillations with very small dispersion in revolution frequency with particle momentum cannot be regarded as ordinary pendulum oscillations because the nonlinearity resulting from higher-order kinematic terms becomes sufficiently significant so as to lead to modification of the standard bucket. These dynamics are important in momentum debunching with RF rotation in, for example, the Debuncher Ring for the Fermilab TeV-I project.

RF is used for quick reduction of large momentum spread to small spread. This large momentum spread places a restriction on the Debuncher of a very small value for the dispersion of revolution frequency with particle momentum due to engineering limitations on the possible RF voltage. The above kinematic nonlinearity may eventually lead to undesirable diffusion in a debunched beam. In this paper the authors discuss how this nonlinearity is suppressed by adjusting the path length of an off-momentum particle with the help of sextupole correction magnets.

12646 **Isolated bucket rf systems in the Fermilab antiproton facility.** Griffin, J.E.; Ankenbrandt, C.; MacLachlan, J.A.; Moretti, A. (Fermi Nat.'l Accelerator Lab., Batavia, IL 60510). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 3502-3505(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

In the Fermilab p^-p colliding beam facility antiprotons are to be collected in an accumulator ring where the injection/extraction orbit length and rotation period are the same as those of the Booster Ring at T = 8 GeV, namely 474.19 m. and 1.59 X 10^{-6} sec. Prior to injection into the Accumulator ring the momentum spread of the antiprotons is reduced by mismatched bunch rotation in a slightly larger Debuncher ring with circumference 505.28 m and rotation period (8 GeV) 1.695 X 10^{-6} sec. Several of the beam manipulations in these rings are facilitated by rf systems capable of applying a longitudinal accelerating field for only part of each rotation period. The accelerating field is "suppressed" for the remainder of the rotation period. The concept of "suppressed bucket" is not new, but the use to which they are put in this project is unique. T /SUB o/ is the synchronous particle rotation period and the voltage is a single complete sinusoid of period T /SUB rf/ . The period T /SUB rf/ can be related to the rotation period by the expression T /SUB o/ = hT /SUB rf/ , where h > 1 but h need not be an integer. The repetition period of the isolated wave can be precisely T /SUB o/ (stationary) or it may differ slightly from T /SUB o/ (moving). Furthermore, the wave need not be sinusoidal as shown or even symmetric about some center point. It must only span some region T /SUB rf/ and it cannot have a dc component. Practical considerations indicate that the wave should be reasonably smooth so that the Fourier spectrum is not excessively broad.

44 INSTRUMENTATION

4401 Radiation Instrumentation

REFER ALSO TO CITATION(S) 11662, 12398, 12595, 12894, 12899

12647 **(AD-A—131407/9) Thermoelectrically cooled focal plane array module. Semi-annual technical report No. 1 (final), 28 Sep 78-28 Feb 79.** Tennant, W.E.; Seib, D.H. (Rockwell International Corp., Thousand Oaks, CA (USA). Science Center). Mar 1979. 114p. NTIS, PC A06/MF A01.

This is the first semi-annual report of a project to develop a thermoelectrically cooled staring focal plane module. The approach is that of a backside-illuminated hybrid mosaic array coupled to a silicon CCD/MUX. The detector approach is based on a transparent substrate/heteroepitaxy technology, and the multiplexer incorporates background skimming, gain reduction, and frame transfer concepts.

12648 **(BDX—613-3024) Measurement capabilities of the Bendix Metrology Organization.** Barnes, L.M. (Bendix Corp., Kansas City, MO (USA)). Jan 1984. Contract AC04-76DP00613. 68p. NTIS, PC A04/MF A01. Order Number DE84005876.

The purpose of this manual is to communicate the measurement and calibration capabilities of the Metrology Organization of the Bendix Kansas City Division. Included is a listing of the measurement types and ranges available, and the accuracies normally attainable under conditions at the Kansas City Division. Also described are currently used standards and measurement devices. The manual is divided into four major sections, each describing a broad general area of measurement: mechanical; environmental, gas, liquid; electrical; and optical and radiation.

12649 **(CEA-R—5234) Measurement of absorbed doses in a homogeneous β rays fields with an extrapolation chamber.** (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France)). Jul 1983. 72p. (In French). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84750472.

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The main characteristics of a variable cavity ionization chamber are described. Using the ionization current of the detector irradiated in homogeneous β rays fields, the tissue absorbed dose is determined. The corrective factors required to compute this quantity are analysed. Finally, international recommendations (ISO standards) relating to β rays reference fields are given, with the characteristics of β sources required for the energy response study of radiation protection instruments.

12650 (CERN—83-02(Vol.2), pp 97-112) **Ideas for a high luminosity muon physics detector with complete particle identification.** Braun, H.M. (European Organization for Nuclear Research, Geneva (Switzerland); Gesamthochschule Wuppertal (Germany, F.R.)). 10 Feb 1983. NTIS (US Sales Only), PC A23/MF A01. (CONF-821256—Vol.2).

From Workshop on SPS fixed-target physics in the years 1984-1989; Geneva, Switzerland (6 Dec 1982).

Modifications of the existing EMC-NA9 spectrometer at the SPS muon beam by using a Time Projection Chamber (TPC) as vertex-detector and Ring Mage Cerenkov (RICH) counters allow at least a factor 5 increase in luminosity and provide complete hadron identification. The compactness of the new detectors gives space for future 4π coverage for neutral particle detection.

12651 (CERN—83-02(Vol.2), pp 161-169) **Study of NEUtrino induced Purely Leptonic reactions with an annular CHerenkov counter (NEUPLACH).** Blondel, F.; Jaquet, F.; Mine, P. (Ecole Polytechnique, 91 - Palaiseau (France)). 10 Feb 1983. NTIS (US Sales Only), PC A23/MF A01. (CONF-821256—Vol.2).

From Workshop on SPS fixed-target physics in the years 1984-1989; Geneva, Switzerland (6 Dec 1982).

A new large detector using Cherenkov light in water is proposed, which gives by measuring the νsub(μ)e scattering an estimation of sin² thetasub(w) with a precision good enough to test high order calculation of the theory.

12652 (CERN—83-02(Vol.2), pp 170-180) **Study of a new detector for neutrino-electron scattering.** Winter, K. 10 Feb 1983. NTIS (US Sales Only), PC A23/MF A01. (CONF-821256—Vol.2).

From Workshop on SPS fixed-target physics in the years 1984-1989; Geneva, Switzerland (6 Dec 1982).

A calorimeter for the study of νsub(μ)e scattering is described.

12653 (CERN—83-02(Vol.2), pp 425-432) **Beam polarization measurements at high energy.** Penzo, A. (Istituto Nazionale di Fisica Nucleare, Trieste (Italy)). 10 Feb 1983. NTIS (US Sales Only), PC A23/MF A01. (CONF-821256—Vol.2).

From Workshop on SPS fixed-target physics in the years 1984-1989; Geneva, Switzerland (6 Dec 1982).

The author describes different types of polarimeters for polarized proton beams and discusses the requirements of accuracy for the measurement of the analyzing power for elastic ep and pp scattering and inclusive production of π^-, π^0, and Λ^0 in pp interactions.

12654 **(IAEA-TC—389/6-9) Large-area self-powered neutron-detectors for neutron-flux measurements in HTRs. Status of developmental work.** Brixy, H.; Hecker, R.; Serpekian, T.; Benninghofen, G.; Serafin, N.; Spillekothen, H.G. (International Atomic Energy Agency, Vienna (Austria); Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung; Internationale Atomreaktorbau G.m.b.H. (INTERATOM), Bergisch Gladbach (Germany, F.R.)). Jun 1982. 12p. (CONF-820653—24). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704351.

From IAEA specialists' meeting on gas-cooled reactor core and high temperature instrumentation; Cumbria, UK (15 Jun 1982).

The development is described of the large-area SPN-detector as an out of core power monitoring system. Gadolinium or cobalt was used as the emitter. Response functions of the gadolinium SPN-detector were found with regard to the reactor power, the effect of the gamma field, its short-term behaviour following reactor shutdown and long-term behaviour during reactor operation. It was shown that a detector of 0.1 mm emitter thickness can withstand an integral thermal neutron flux of 2.10^{20} nvt almost without efficiency loss thus indicating that the large-area gadolinium SPN-detector is a suitable means for power monitoring in large HTGR's.

12655 **(IFVE-OEA-ONF—82-16) Optical system of the MEhLAS cathode ray tube-analyzer.** Mukhajlov, O.I.; Kryutchenko, E.V.; Utochkin, B.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1982. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704168.

An optical system of an automated device intended for processing the film data from big bubble chambers is described. The main peculiarity of the applied optical system is the use of a measuring cathode-ray tube for manual guidance of the scanning spot to the selected film regions. The optical system under consideration provides the easily variable participation of an operator in the processes of film processing, namely in-the-process visual control, aim selection, scanning and analysis of pictures.

12656 (INIS-mf—8156, pp 231-234) **^{82}Se time projection chamber for double beta decay.** Moe, M.K.; Brown, H.E.; Hahn, A.A. (California Univ., Irvine (USA). Dept. of Physics). 1982. NTIS (US Sales Only), PC A19/MF A01. (CONF-820675—Vol.1).

From International conference on neutrino physics; Balaton, Hungary (14 Jun 1982).

A report on the UCI Time Projection Chamber (TPC) is given. The new experiment was designed to overcome the low (2%) efficiency of the cloud chamber and also allow a more automated analysis of the data. The Helmholtz coils, the lead shielding house, the 4π multiwire proportional chamber cosmic-ray veto, and finally the TPC itself are worth mentioning. The crossed anode and cathode wire planes give the X and Y positional information. ^{82}Se sample (97% enriched) is contained between the two aluminized mylar sheets. Both sides of the source are active. A typical double beta event is also shown.

12657 **(INS-P—157) BASIC program for handling strontium mass spectrometric data.** Duckworth, E. (Department of Scientific and Industrial Research, Lower Hutt (New Zealand). Inst. of Nuclear Sciences). Feb 1981. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704369.

A commentary is given for a BASIC program, which operates the HAL microprocessor system on the MM30B solid source mass spectrometer used for rubidium strontium dating. Specifically, the program controls the acquisition of rubidium and strontium isotopic data and performs calculations for determination of the ^{86}Sr/^{87}Sr ratio in geological materials. Some basic technical data and operating parameters for the mass spectrometer and annotated program listing are given.

12658 **(JINR-R—1-83-12) Determination of the time-coordinate dependence for drift chambers in the πe and K-e scattering experiments at p = 250 GeV/c.** Vodop'yanov, A.S.; Nigmanov, T.S.; Ryabtsov, V.D.; Tsyganov, Eh.N. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1983. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704352.

Determination of the time-coordinate dependence for drift chambers in the π-e and K-e scattering experiment at p=250 GeV/c is described. Drift time was measured by a time-digital converter, a coordinate-using the proportional chambers. A quadratic polynomial function is agreeable to the experimental data. The coefficients of the function are found to be the same for the signal wires located in one drift chamber module. A knowledge of the time-coordinate dependence makes possible to improve in experiment an accuracy of calculating coordinates and angles of charged particles.

12659 (KIYI—81-10, pp 41-46) **Two-dimensional position-sensitive detector as an device for shadow effect measurement.** Charnatski, V.; Moroz, Z.; Shimchak, M.; Vojtkovskaya, I. 1981. (In Russian). NTIS (US Sales Only), PC A04/MF A01.

In Semiconductor detector application in nuclear physics experiments.

Application of two-dimensional detectors for determination of nuclear reaction life time is described. Measurements have been conducted on a proton beam of the INR linear accelerator in Swierk. Silicon monocrystals have been used as targets. Detector test and its calibration have been exercised by means of ThB α-source. It is shown that two-dimensional position-sensitive detector can be applied for observation of bracking schemes in monocrystals and, particularly, it can be used for measuring lifetime of the reactions in which light particles such as protons, deutrons or α-particles are emitted.

12660 **(PB—83-243022) High resolution energy analysers for the high throughput inelastic spectrometer.** Penfold, J. (Rutherford Appleton Lab., Chilton (UK)). [nd]. 27p. (RL—82-038). NTIS, PC E04/MF E04.

An evaluation was carried out of energy analysers for the High Throughput Inelastic Spectrometer, HTIS, suitable for energy transfers less than 50 meV. The HTIS is a high count rate instrument and provides the neutron scattering equivalent of infrared spectroscopy for the study of molecular vibrations. Calculations were carried out of energy transfer resolution and count rates for various analyser systems, including graphite, difference and window filters (e.g. Be/BeO) multilayer mirrors, benders and crystal analysers. The results showed that Be/MgO or Be/BeO difference filters are the most suitable high resolution energy analysers for HTIS, but Be/MgO has superior resolution especially at energy transfers less than 100 meV.

12661 **(PB—83-254201) Physics of charged particle identification: dE/dx, Cerenkov and transition radiation.** Allison, W.W.M.; Wright, P.R.S. (Oxford Univ. (UK). Nuclear Physics Lab.). 1983. 45p. NTIS, PC E04/MF E04.

Contents: Theory -- (General discussion; Cerenkov radiation and dE/dx; Transition radiation and Cerenkov radiation); Calculations for practical devices -- (Cerenkov counters; Transition radiation devices; dE/dx detectors); Appendix -- The solution of practical problems for dE/dx detectors.

12662 **(TU-Inf—05-06-81) Calibration factors for dosemeter characterization.** Doerschel, B.; Schuricht, V. (Technische Univ., Dresden (German Democratic Republic). Sektion Physik). 1981. 8p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704353.

Calibration factors or dosemeter sensitivities can be used for linking the measured physical effect with the biological effect. Calibration factors have been determined for a solid-state track detector system (cellulose triacetate foil and LiF) in different neutron fields (^{252}Cf fission neutrons, WWR-S reactor neutrons with and without Cd and Fe shielding, (d,d) generator neutrons, U-120 cyclotron neutrons with and without Fe and paraffin shielding, 9.2 MeV neutrons, and (d,t) generator neutrons). The influence of physical fac-

tors on the calibration factor and on the measuring range and measuring accuracy is demonstrated and discussed.

12663 **(TU-Inf—05-10-81) Properties of TL dosemeters after irradiation with high heavy ion doses.** Huebner, K. (Technische Univ., Dresden (German Democratic Republic). Sektion Physik). 1981. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704354.

The TL phosphors LiF:Mg,Ti and CaF_2:Mn (Dohnalum products in powder and disk form) have been irradiated with high doses of 630 MeV protons, 73 MeV ^{12}C and 75 MeV ^{16}O ions. The dose-response characteristics in the dose ranges of 10^{-1} to 10^{5} Gy and the glow curves are presented and discussed. The relative sensitivities of the TL detectors are derived.

12664 **(TU-Inf—05-13-81) Measuring device for reading optically stimulated luminescent detectors.** Fellinger, J.; Henniger, J.; Huebner, K.; Melde, C.; Prokert, K. (Technische Univ., Dresden (German Democratic Republic). Sektion Physik). 1981. 12p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704355.

A measuring device for reading optically stimulated luminescent detectors is described in detail. It consists of the following main parts: reading unit, control unit, data processing unit, current integrator, temperature control unit for Peltier cooling, reference light source, and power supply. First experience and the achievable accuracy of measurements are reported.

12665 **(UCID—19994) Characterization of a precision radiation gauge.** Fletcher, S. (Lawrence Livermore National Lab., CA (USA)). 4 Jan 1984. Contract W-7405-ENG-48. 20p. NTIS, PC A02/MF A01. Order Number DE84006259.

The purpose of this work was to characterize the DXT system owned by the Nondestructive Evaluation Section and to determine the minimum detectable change in thickness seen by this system for 5 common materials. Errors in data set due to positioning variations, system drifts, and collimator design were observed. Positioning inconsistencies from 0.01 to 0.13 mm were noticed for downward stage movement. Other axial movement accuracies were within the smallest step size limit, linearly equal to 0.01 mm. Cumulative error in transmission data was less than 0.1 percent. Emission and small signal data varied from 7.6 to 13.8 percent by changing the collimator composition from D-38, uranium-238 to lead. The detectable change in thickness values obtained by this work were comparable to that obtained by a similar system years earlier. Overall system performance is very sound. But to minimize errors, the system should be allowed to run for up to 60 minutes before scanning begins, and move upward while scanning. Before data is taken the user should determine the best collimator to use: D-38 for transmission data, lead for emission data, and the relative aperture size must be considered.

12666 **Personal alpha contamination simulator and detector.** Insinger, R.H.; Rodemann, A.H. US Patent Application 6-498,337. 26 May 1983. 11p.

A simulated radiation source and a compatible detector system are disclosed. The combination is useful in training for detecting alpha radiation contamination. A flexible, soft iron plate or first permanent magnet in the detector system responds to a second magnet that is employed to represent an alpha radiation source. Where the first permanent magnet is used, an iron member may be adopted in lieu of the second magnet. The simulated source is affixed to the subject's clothing or body. When the detector system is brought into proximity with the simulated radiation source, the soft plate or first magnet responds and affects a strain gage which in turn provides an electronic indication.

12667 **Pistol-shaped dosimeter charger.** Maples, R.A. US Patent Application 6-460,502. [nd]. 14p. Contract W-7405-ENG-26.

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A pistol-shaped charger assembly clamps a cylindrical radiation dosimeter against one edge thereof. A triggerlike lever on the handgrip of the assembly is manually pivoted to actuate a piezoelectric current generator held in the handgrip and thereby charge the dosimeter.

12668 **Dual concentric crystal low energy photon detector.** Guilmette, R.A. US Patent Application 6-461,370. [nd]. 16p. Contract AC04-76EV01013.

A photon detector for biological samples includes a block of NaI(T1) having a hole containing a thin walled cylinder of CsI(T1). At least three photo multiplier tubes are evenly spaced around the parameter of the block. Biological samples are placed within the hole, and emissions which are sensed by at least two of the photo multipliers from only the NaI(T1) detector are counted.

12669 **Portable neutron spectrometer and dosimeter.** Waechter, D.A.; Erkkila, B.H.; Vasilik, D.G. US Patent Application 6-464,841. [nd]. 46p. Contract W-7405-ENG-36.

The disclosure relates to a battery operated neutron spectrometer/dosimeter utilizing a microprocessor, a built-in tissue equivalent LET neutron detector, and a 128-channel pulse height analyzer with integral liquid crystal display. The apparatus calculates doses and dose rates from neutrons incident on the detector and displays a spectrum of rad or rem as a function of keV per micron of equivalent tissue and also calculates and displays accumulated dose in millirads and millirem as well as neutron dose rates in millirads per hour and millirem per hour.

4402 Radiation Effects On Instrument Components, Instruments, Or Electronic Systems

REFER ALSO TO CITATION(S) 12443

12670 **(AD-A—132325/2) Low-power radiation-hard Gaas Ram. Semi-annual technical report, 10 December 1982-9 June 1983.** Zucca, R.; Vahrenkamp, R. (Rockwell International Corp., Thousand Oaks, CA (USA). Microelectronics Research and Development Center). Aug 1983. 45p. NTIS, PC A03/MF A01.

The scope of this program is to demonstrate a 4K GaAs static RAM having very low power dissipation, 1 microwatt bit in standby, and a short access time, 10 ns, to meet the requirements of the DARPA Advanced On-Board Signal Process (AOSP). At the end of the previous program, a RAM cell capable of the required power dissipation had been developed and a 256-bit RAM had been demonstrated. In the six-month period covered by this report, the processing of several lots of three-inch wafers with 256-bit RAMs (mask set RM3) was completed. Modifications to the Cermet deposition process for high value resistors were required to adapt to the processing of 3-inch wafers, resulting in resistor uniformity that is good or better than the Cermet resistor uniformity formerly achieved for 1-inch wafers. Testing of the 256-bit RAM has been completed. A total of 15 totally functional RAMs have been identified. The read access time was as low as 1 ns. Write operations could be performed with 2 ns write pulses. A 1K RAM was designed, and the corresponding mask set was completed, except for final checking and placement of the circuits on the reticle. Small changes in cell design were made to achieve higher tolerance to threshold voltage variation and to leakage currents.

12671 **(DOE/CS/83110—T2) Quenching of molecular fluorescence near the surface of a semiconductor.** Hayashi, T.; Castner, T.G.; Boyd, R.W. (Rochester Univ., NY (USA)). [nd]. Contract FG02-80CS83110. 16p. NTIS, PC A02/MF A01. Order Number DE84005235.

The fluorescence efficiency of thin evaporated films of tetracene has been investigated as a function of distance from the surface of Si and GaAs utilizing LiF as a spacer. The nonradiative decay rate decreases exponentially with spacer thickness below ~ 400 A. These results differ from theoretical predictions based on a dipole-dipole interaction between a single molecule and the semiconductor.

12672 **(UCRL—52000-83-11, pp 20-33) Modeling EMP damage to semiconductors.** Nov 1983. NTIS, PC A03/MF A01.

In Energy and technology review.

Mechanisms that can cause damage to P-N junction devices in an electromagnetic pulse (EMP) environment were examined

along with existing models for these mechanisms, with the objective of developing models that can accurately predict the input power threshold for device failure.

4403 Miscellaneous Instruments

REFER ALSO TO CITATION(S) 11962, 11963, 12648, 13077

12673 **(AD-A—131720/5) Laser physics and laser spectroscopy. Final technical report, 15 March 1981-14 April 1983.** Byer, R.L. (Stanford Univ., CA (USA). Edward L. Ginzton Lab.). Jun 1983. 83p. (GL—3598). NTIS, PC A05/MF A01.

During the past year a theoretical study of laser ionization mass spectroscopy has been completed. The study evaluated laser ionization combined with Fourier transform mass spectroscopy. A second generation single crystal fiber growth machine has been completed and high quality fibers of sapphire have been grown. Rapid progress in the growth and evaluation of small diameter single crystal fibers for nonlinear optical device application is being made. Theoretical model studies for laser plasma pumping of indium ion for a vacuum ultraviolet laser source have been carried out. Experiments have been initiated. The laser produced plasma X-ray source to other X-ray sources such as synchrotron and rotating anodes have been studied and compared. It is clear that the laser plasma X-ray source has an important role to play in soft X-ray spectroscopy, X-ray lithography and X-ray microscopy.

12674 **(AD-A—131825/2) Owens valley frequency-agile interferometer. Technical report.** Hurford, G.J. (California Inst. of Tech., Pasadena (USA)). Mar 1983. 24p. (SCIENTIFIC—1). NTIS, PC A02/MF A01.

The solar microwave spectrum encodes significant information on plasma parameters, magnetic field strengths and characteristics of accelerated electrons in solar flares and active regions. The solar interferometer of the Owens Valley Radio Observatory has recently been converted to frequency-agile operation to effectively become a high resolution, interferometric spectrometer. The interferometer uses two moveable, 27 m diameter parabolic antennas equipped with frequency-agile receivers. These receivers are capable of switching their observing frequency in less than 50 ms between any of 86 different frequencies in the range 1 to 18 GHz. All data are absolutely calibrated with respect to cosmic sources. In 1981, observations with one frequency-agile receiver were conducted and high resolution spectra of many flares were obtained. One unexpected aspect of such spectra were narrow-band bursts, which featured sharp high- and low-frequency cutoffs and a relatively narrow bandwidth.

12675 **(AD-A—132155/3) Laser Doppler velocimeter for measurement of flows induced by flames propagating over condensed fuels.** Santoro, R.J. (Princeton Univ., NJ (USA). Dept. of Aerospace and Mechanical Sciences). Sep 1974. 44p. NTIS, PC A03/MF A01.

The primary process in the spread of fire along the surface of a condensed fuel is heat transfer from the burning region of the fuel to the material ahead of the flame. In the early stages of a fire, the two mechanisms by which this heat transfer occurs are conduction and convection ahead of the flame through the gas and fuel phases. The determination of the importance of the convective heat transfer can be ascertained only by accurate measurement of the fluid flow velocity and temperature fields near the flame front. Convective flows induced by spreading flames are characterized by low fluid velocities with changes in magnitude and direction accompanied by sharp temperature changes occurring over small distances. The bulk gas velocity induced by the flame frequently opposes the propagation. In liquids, there exists, as well, a liquid motion in the direction of the propagation of the flame. These characteristics make quantitative measurements of fluid velocities difficult using conventional techniques. With the advent of Laser Doppler Velocimeter (LDV) techniques, a non-perturbing means of making high resolution measurements of two-dimensional low velocity fields now exists. Thus, the possibility of determining the role of convective effects has become realizable.

12676 **(JINR-R—13-82-912) Hall magnetometer with enhanced resolving power and its application.** Akhmanova, L.N.; Lachinov, V.M.; Makoveev, V.K.; Starikov, A.M. (Joint Inst. for Nuclear Research, Dubna (USSR). Dept. of New Acceleration Methods). 1982. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704357.

The instrument is intended for mesuring the stationary magnetic fields up to 5 T and their inhomogeneities. It consists of two measuring channels, one gradient channel and that one for registration of deviation of a value measured relative to the reference signal. The result registration is performed via the external digital voltmeter with approximately 0.01% error. Magnetometer resolving power for relative and gradient measurements in the superconducting solenoid with a "frozen" magnetic field is as high as 10^{-5} T in the field up to 5 T. The way of measuring the direction of magnetic field is realized with angular accuracy better than one minute using one Hall transducer.

12677 **(LBL—16937) Electron microscopy at atomic resolution.** Gronsky, R. (Lawrence Berkeley Lab., CA (USA)). Nov 1983. Contract AC03-76SF00098. 28p. (CONF-831174—66). NTIS, PC A03/MF A01. Order Number DE84005546.

From Materials Research Society annual meeting; Boston, MA, USA (14 Nov 1983).

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The direct imaging of atomic structure in solids has become increasingly easier to accomplish with modern transmission electron microscopes, many of which have an information retrieval limit near 0.2 nm point resolution. Achieving better resolution, particularly with any useful range of specimen tilting, requires a major design effort. This presentation describes the new Atomic Resolution Microscope (ARM), recently put into operation at the Lawrence Berkeley Laboratory. Capable of 0.18 nm or better interpretable resolution over a voltage range of 400 kV to 1000 kV with +- 40° biaxial specimen tilting, the ARM features a number of new electron-optical and microprocessor-control designs. These are highlighted, and its atomic resolution performance demonstrated for a selection of inorganic crystals.

12678 **(MINTEK-M—68) Suitability of Doppler flowmeters for use in the minerals-processing industry.** Ormrod, G.T.W. (Council for Mineral Technology, Randburg (South Africa)). 3 Jan 1983. 22p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704358.

In this report, six commercially available Doppler flowmeters, which were operated under conditions likely to be encountered in the minerals-processing industry, are evaluated. The effects of the density and particle-size distribution of a flowing slurry and the optimum siting of the flowmeter probe are considered, and the results of tests on the response and linearity of the flowmeters are reported.

12679 **(MLM—3130) MA-2026 Environmental Monitoring System.** Spyrou, E. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 27 Jan 1984. Contract AC04-76DP00053. 17p. NTIS, PC A02/MF A01. Order Number DE84006222.

The MA-2026 EMS (Environmental Monitoring System) is a transportable system that has the capability to acquire and accumulate environmental information with respect to real time, in a pseudo intrinsically safe environment. The MA-2026 EMS manipulates the accumulated information from its various sensors and converts it into engineering units; then it either displays that information in real time or saves it on permanent records such as cassette tape for future analysis. The MA-2026 system was designed to aid in the analysis of the effect of the environment on various developmental as well as manufacturing processes at Mound.

12680 **(PB—83-233924) Preliminary report on the evaluation of selected ultrasonic and gyroscopic flowmeters at cryogenic temperatures. Final report.** Brennan, J.A.; Takano, A. (National Bureau of Standards, Washington, DC (USA)). 1982. 4p. Pub. in Proceedings of International Cryogenic Engineering Conference, Kobe, Japan, May 11-14, 1982, p655-658 1982.

Several ultrasonic and gyroscopic flowmeters were tested on the cyrogenic flow facility at the National Bureau of Standards (NBS) in Boulder, Colorado. Meters were evaluated using liquid nitrogen with flow rates with temperatures ranging from 0.13 to 2.25 liters/second for small meters and from 1.45 to 13.1 liters/second for a larger meter, with pressures ranging from 0.41 to 0.80 MPa and 79 to 91 K. Results for the test showed flowmeters evaluated, with one exception, their applicability to cryogenic service with appropriate consideration of their characteristics at low temperatures.

12681 **(SAND—83-2325) Location errors in time-of-arrival types of systems with augmenting equations.** Aronson, E.A. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1983. Contract AC04-76DP00789. 31p. NTIS, PC E03/MF A01. Order Number DE84006250.

Includes 1 sheet of 48x reduction microfiche.

The mean and covariance of object location errors in time-of-arrival (TOA), time-difference-of-arrival (TDOA), and time-squared-difference (TSQD) systems are estimated in this report. These errors are due to errors in the assumed locations of the devices sensing the TOA data and in the measuarement of the TOA data itself. Also given is an analysis of the errors in these systems if the model vector is augmented with constraint-like equations. In the somewhat special case where system three-space geometry induces large location error covariances, an analysis is presented of the errors in an approximating two-space system.

12682 **(UCID—19982) Evaluation of the IRAD sonic extensometers for application in the Canadian Underground Research Laboratory (FY 1983).** Glenn, H.D.; Butler, L.S. (Lawrence Livermore National Lab., CA (USA)). Sep 1983. Contract W-7405-ENG-48. 32p. NTIS, PC A03/MF A01. Order Number DE84006226.

This report supplements an earlier study that discussed the suitability of using the IRAD sonic extensometer in the Underground Research Laboratory proposed by the Atomic Energy of Canada, Ltd. In particular, it addresses the first and fourth recommendations made in that report concerning the basic accuracy of the instrument and evaluation of the electronic circuitry, respectively.

12683 **Non-obstructing laser beam sampling meter.** Roberts, T.G.; Honeycutt, T.E. US Patent Application 6-499,593. 31 May 1983. 9p.

Document describes an non-obstructing laser beam sampling meter which measures the power output of a laser by utilizing the optogalvanic effect in the electrode space of a glow discharge which is made to operate on the left side of the Paschen curve where breakdown voltage increases with decreasing pressure.

12684 **Laser clock.** Facklam, R.L. US Patent Application 6-498,238. 26 May 1983. 14p.

A laser clock includes a linear laser in one embodiment of the clock and a ring laser gyro in the other embodiment. The linear laser is frequency stabilized and utilizes a single active medium in the form of a low pressure gas, such as He-Ne, with a Doppler broadened gain curve. The ring laser gyro is a four frequency laser with a Faraday rotor. Detector and electronic circuitry associated with the laser of each embodiment detects a beat frequency and convert it to a clock signal.

12685 **Apparatus for accurately measuring high temperatures.** Smith, D.D. US Patent Application 6-464,839. [nd]. 13p. Contract W-7405-ENG-26.

The present invention is a thermometer used for measuring furnace temperatures in the range of about 1800° to 2700°C. The thermometer comprises a broadband multicolor thermal radiation sensor positioned to be in optical alignment with the end of a blackbody sight tube extending into the furnace. A valve-shutter arrangement is positioned between the radiation sensor and the sight tube and a chamber for containing a charge of high pressure gas is positioned between the valve-shutter arrangement and the radiation sensor. A momentary opening of the valve shutter arrangement allows a pulse of the high gas to purge the sight tube of air-borne thermal radiation contaminants which permits the radiation sensor to accurately measure the thermal radiation emanating from the end of the sight tube.

12686 **InP:Fe photoconducting device.** Hammond, R.B.; Paulter, N.G.; Wagner, R.S. US Patent Application 6-447,349. [nd]. 11p. Contract W-7405-ENG-36.

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A photoconducting device fabricated from Fe-doped, semi-insulating InP crystals exhibits an exponential decay transient with decay time inversely related to Fe concentration. Photoconductive gain as high as 5 is demonstrated in photoconducting devices with AuGe and AuSn contacts. Response times from 150 to 1000 picoseconds can be achieved.

12687 **Laser beam monitoring system.** Weil, B.S.; Wetherington, G.R. Jr. US Patent Application 6-450,305. [nd]. 8p. Contract W-7405-ENG-26.

Laser beam monitoring systems include laser-transparent plates set at an angle to the laser beam passing therethrough and light sensor for detecting light reflected from an object on which the laser beam impinges.

12688 **Apparatus for measuring fluid flow.** Smith, J.E.; Thomas, D.G. US Patent Application 6-455,612. [nd]. 14p. Contract W-7405-ENG-26.

Flow measuring apparatus includes a support loop having strain gages mounted thereon and a drag means which is attached to one end of the support loop and which bends the sides of the support loop and induces strains in the strain gages when a flow stream impacts thereon.

12689 **Precision liquid level sensor.** Field, M.E.; Sullivan, W.H. US Patent Application 6-469,596. [nd]. 13p. Contract AC04-76DP00789.

A precision liquid level sensor utilizes a balanced bridge, each arm including an air dielectric line. Changes in liquid level along one air dielectric line imbalance the bridge and create a voltage which is directly measurable across the bridge.

4404 Well Logging Instrumentation

12690 **(NMERDI—2-71-4634) SMAC - Sonic Mapping and Caliper research and development. Final report, Phase IA.** Handy, L.E. (Hot Hole Instruments, Los Alamos, NM (USA)). Nov 1983. 17p. Univ. of New Mexico, 117 Richmond Drive, N.E., Albuquerque, NM 87106.

Phase IA of this project consisted of developing and testing the Sonic Mapping and Caliper (SMAC) Tool in both an oil and a geothermal well. The first field test of the SMAC was successfully run in an oil well located in Edmonton, Canada. The well had an inner diameter (I.D.) of seven inches and was cased to 3300 feet. An additional 120 feet of the well was open hole. The log from this test recorded each collar location, the casing conditions, and the fracture zone in the open hole. In the course of the test it was immediately possible to determine the DIP angle of the fractures during real time transmission of the data to the surface. The second and third field tests were conducted at the Geothermal Site, Fenton Hill, New Mexico. Test No. 2 was run in the cased portion of Well GT-2. The SMAC Tool went to a depth of 2000 feet at a temperature of approximately 100°C. The performance of the SMAC Tool was excellent and yielded collar location and casing condition information. Test No. 3 was run in a 9-5/8 inch I.D. cased portion of Well EE-2. The test was run to a depth of 750 feet at a temperature of 75°C. One of the purposes of this test was to compare the SMAC Tool with the Sandia Simplec Tool. The SMAC Tool log provided a clearer and more detailed picture of the interior of the casing than did the log of the Sandia Simplec Tool. Based on the encouraging results of these tests, we are confident that the Phase

II SMAC Tool can be further developed to include a 24-point caliper and a three-dimensional graphic display in order to provide more information about the conditions inside oil and geothermal wells. The SMAC Tool can also be developed to include a gyroscope system for orienting the log in relationship to North and a high temperature and pressure option.

45 EXPLOSIONS AND EXPLOSIVES

4502 Nuclear

REFER ALSO TO CITATION(S) 12868

12691 **(AD-A—131707/2) Montana lasa (large aperture seismic array) operation. Technical report for period ending January 1978.** (Ford Aerospace and Communications Corp., Billings, MT (USA). Engineering Services Div.). 6 Feb 1978. 15p. NTIS, PC A02/MF A01.

This report describes the Montana Large Aperture Seismic Array (LASA) Operations under project VELA T/8708 during the January 1978. Operation of the LASA provides data to the seismic community through the Seismic Data Analysis Center. Defense Advanced Research Projects Agency (DARPA) objective to demonstrate the utility of large seismic arrays in the detection and discrimination of earthquakes and underground explosions.

12692 **(AD-A—132267/6) Nuclear war: a selective bibliography, 1977-1982.** (Army Library, Washington, DC (USA)). Dec 1982. 50p. NTIS, PC A03/MF A01.

This bibliography lists books, general and legal periodical articles, and congressional materials on the strategy and consequences of nuclear warfare. Cited items were published during the period 1977-1982.

12693 **(AD-A—132406/0) Fields and currents and charges on obstacles in a parallel-plate simulator at selected frequencies and with pulse excitation. Final report, 2 February 1981-1 May 1983.** Wu, T.T.; Krook, M.; King, R.W.P.; Shen, H.M.; Bansal, R. (Harvard Univ., Cambridge, MA (USA). Gordon McKay Lab.). Aug 1983. 56p. NTIS, PC A04/MF A01.

This final report summarizes the results of a 2-year study performed at Harvard University to determine the properties of the Harvard model simulator at selected frequencies and under pulse excitation. The continuous-wave (CW) study is completed with measurements at intermediate frequencies; a novel series apron device is developed to improve the performance in this frequency range. The pulse study begins with a theoretical and experimental investigation of the simpler rhombic simulator, and concludes with an investigation of the Harvard parallel-plate simulator. Both the rhombic and the metal-plate simulators exhibit unexpected complications which require further study. Each feature is examined individually and the sources of the many parasitic pulses are determined. Methods for eliminating the undesired pulses are presented, along with a new experimental technique to reduce the systematic interference and a new theory to solve for the current in the time domain.

12694 **(UCRL—53437) Riola release report.** Woodward, E.C. (Lawrence Livermore National Lab., CA (USA)). 4 Aug 1983. Contract W-7405-ENG-48. 39p. NTIS, PC A03/MF A01. Order Number DE84005750.

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Eleven hours after execution of the Riola Event (at 0826 PDT on 25 September 1980) in hole U2eq of the Nevada Test Site (NTS), a release of radioactivity began. When the seepage stopped at about noon the following day, up to some 3200 Ci of activity had been dispersed by light variable winds. On 26 September, examination of the geophone records showed six hours of low-level, but fairly continuous, activity before the release. Electrical measurements indicated that most cables were still intact to a depth below the stemming platform. A survey of the ground zero area showed that the seepage came through cracks between the surface conductor and the pad, through cracks in the pad, and through a crack adjacent to the pad around the mousehole (a small hole adjacent to the emplacement hole). To preclude undue radiation exposure or injury from a surprise subsidence, safety measures were instituted. Tritium seepage was suffucient to postpone site activities until a box and pipeline were emplaced to contain and remove the gas. Radiation release modeling and calculations were generally consistent with observations. Plug-hole interaction calculations showed that the alluvium near the bottom of the plug may have been overstressed and that improvements in the design of the plug-medium interface can be made. Experimental studies verified that the surface appearance of the plug core was caused by erosion, but, assuming a normal strength for the plug material, that erosion alone could not account for the disappearance of such a large portion of the stemming platform. Samples from downhole plug experiments show that the plug may have been considerably weaker than had been indicted by quality assurance (QA) samples. 19 references, 32 figures, 10 tables.

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC

5001 Basic Studies

REFER ALSO TO CITATION(S) 11792, 12718

12695 **(ANL/ER—83-1) Remote sensing of winds and turbulence above complex terrain during ASCOT-1980.** Coulter, R.L.; Martin, T.J. (Argonne National Lab., IL (USA)). Dec 1983. Contract W-31-109-ENG-38. 172p. (ASCOT—83-4). NTIS, PC A08/MF A01. Order Number DE84005231.

Wind and thermal structure in the planetary boundary layer (PBL) above the Anderson Creek Valley in California were measured with a Doppler sodar system and three laser anemometers during a large, multiorganizational ASCOT experiment conducted in 1980. The Argonne National Laboratory bistatic Doppler system was used successfully to measure profiles of mean and turbulent components of vertical and horizontal winds at heights up to 500 m above the surface within the pooling region of several merging valleys. The laser anemometers were deployed to measure mean flow and thermal turbulence above individual creek valleys. Detailed information is given on the local characteristics and diurnal variation of flow as influenced by nighttime drainage flows, up-slope currents during the daytime, synoptic flow, and sea breezes. The methods of observation are described, and the data obtained are summarized in tables, figures, and appendices; some interpretation of data is provided. These results, together with the extensive data from other organizations participating in the program, can be used to obtain a rather complete description of flow characteristics above the valley surface. 30 references, 10 figures, 4 tables.

12696 **(PB—84-105295) World geography of recoverable carbon resources in the context of possible climatic changes. Master's thesis.** Heede, R. (National Center for Atmospheric Research, Boulder, CO (USA)). 1983. 145p. (NCAR/CT—72). NTIS, PC A07/MF A01.

The world distribution of the carbon-based energy resources is examined in the context of possible future climatic change resulting from their recovery and combustion. Climate modeling and energy/climate scenarios are reviewed. For each of the five fossil fuels, presumed remaining recoverable resources are calculated, employing an analysis of its geology, discovery and production techniques, and especially the economic and energy balance characteristics of importance to its present and future recovery. Brief analyses of the momentum of the carbon economy, market competition, energy system phasing, and the socio-political factors influencing energy growth and energy policy suggest that CO2 emissions are likely to grow more slowly than projected elsewhere but nonetheless threaten climatic stability.

5002 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 11452, 11538, 11856, 12129, 12130, 12133, 12396, 12417, 12436, 12533, 12712, 12713, 12721, 12848, 12855, 12857, 12858, 12859

12697 **(CONF-8310220—2) Meteorologically induced uncertainty in LRT modeling.** Knudson, D.A.; Shannon, J.D. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 8p. NTIS, PC A02/MF A01. Order Number DE84003444.

From International specialty conference on the meteorology of acidic deposition; Hartford, CT, USA (16 Oct 1983).

Meteorological conditions which control atmospheric transport and deposition may exhibit large annual variability. The implications of this variability when a single year (or even shorter period) of meteorological data is used to simulate source/receptor relationships for policy or regulatory analysis are quite clear. This paper presents a preliminary indication of potential annual variability. Meteorological data for two consecutive years (1980 and 1981) are examined through use of the Advanced Statistical Trajectory Regional Air Pollution (ASTRAP) model for a group of source/receptor combinations in eastern North America. Source/receptor distances range from about 400 through 1200 km, with receptors generally in the northeast quadrant of sources. Results of the analysis indicate that seasonal percentage differences for total deposition between the two years for particular source/receptor combinations are as high as 80 to 100%. For most source/receptor combinations, however, differences are much lower. Maximum annual differences are about 20%. Although two years is an inadequate sample for statistical tests of hypotheses, there is a slight seasonal tendency for wet deposition to be most variable during the summer season and no apparent seasonal pattern for dry deposition variability. There appears to be no correlation between source/receptor distance and deposition variability. 2 references, 4 tables.

12698 **(DOE/ER—0188) Carbon cycle research plan.** Dahlman, R.C. (USDOE Office of Energy Research, Washington, DC. Office of Basic Energy Sciences). Jan 1984. Contract W-7405-ENG-26. 40p. NTIS, PC A03/MF A01. Order Number DE84006221.

The principal objective of the carbon cycle research plan is to develop the ability to estimate change in atmospheric CO_2 concentration expected to accompany additional combustion of fossil fuels. Related objectives are to understand how other perturbations (such as forest clearing and climate change) of biogeochemical processes may alter the global carbon cycle, as well as to estimate mitigation capacities of natural components of the global carbon system. The emphasis is on providing projections of future releases of CO_2 from fossil fuel; documenting contemporary and future changes of atmospheric CO_2; developing improved estimates of CO_2 uptake by oceans; and clarifying the role of the biosphere in the global carbon cycle. Carbon cycle models will be used to integrate data and to calculate future atmospheric CO_2 changes. Integrated approaches for achieving the plan's objectives require acquisition and analysis of data on CO_2 exchange among atmosphere, ocean, and biosphere reservoirs. The focus is on evaluating the fate of the modern fossil CO_2 in these reservoirs. The priority is to define fluxes of carbon in the biogeochemical cycle which affect the atmospheric concentration of CO_2 and to integrate the empirical data by means of carbon cycle models in predictive simulations of the fossil perturbation. This research plan is a revision of an earlier plan based partially on recommendations of the National Academy of Sciences/National Research Council (NAS/NRC) study of effects of energy processes on climatic (NRC 1977), and partially on a subsequent scientific analysis of the CO_2 issue (Elliott and Machta 1979). This revised plan adjusts research priorities of some previously defined questions; it suggests modified approaches gained from experience; and it identifies products needed for mid-term and longer range assessments of the CO_2-climate issue. 45 references, 8 figures, 1 table.

12699 **(KFK—3477) Three- and four-parameter diffusion statistics as a basis for calculating the long-term pollution load.** Vogt, S. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Hauptabteilung Sicherheit). Jun 1983. 86p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE84750077.

Diffusion statistics are required to calculate the long-term pollutant load. In case pollutant washout by precipitation is not taken into consideration, three-parameter statistics are sufficient. They are understood to include the frequency distribution of the combination consisting of wind direction, wind speed and stability class. In case also washout is to be taken into account, the frequency distribution of these three parameters must be extended to include the precipitation parameter. It is shown how, starting from a set of data of 10-minute mean values collected over ten years, these diffusion statistics can be elaborated by generation of half-hour values. Besides, the measuring instruments are described which are used in the determination of these four parameters. In the tables the three- and four-parameter diffusion statistics are indicated.

12700 **(LBL—15298(Excerpt)) Atmospheric aerosol research FY 82.** Novakov, T. (Lawrence Berkeley Lab., CA (USA)). Jul 1983. Contract AC03-76SF00098. 30p. NTIS, PC A03/MF A01. Order Number DE84004308.

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This annual report describes research on the chemistry and measurement of atmospheric aerosols. Separate abstracts have been prepared for the 10 articles presented. (ACR)

12701 **(PB—83-237461) Humidity calculations used for mobile source emission testing. Technical report.** Zellin, E. (Environmental Protection Agency, Ann Arbor, MI (USA)). Feb 1983. 18p. NTIS, PC A02/MF A01.

This report provides a summary of the calculations used to determine relative and specific humidity of moisture in air for mobile source (motor vehicle and engine) emission and fuel economy testing at the U.S. Environmental Protection Agency Motor Vehicle Emissions Laboratory in Ann Arbor, Michigan. The reference includes calculations required to determine the saturation vapor pressure of water, psychrometric equations used to calculate the partial pressure of water vapor for wet-bulb psychrometers, and equations for the enhancement factor of water and ice. Also included are the methods used from 1971 to the present (1982).

12702 **(PB—83-261768) Chemistry, physics, and optical properties of plumes and background air in the southwest United States. Interim report, 4 May 1979-1 November 1981.** Blumenthal, D.L.; Richards, L.W.; Macias, E.S.; Bergstrom, R.W.; Bhardwaja, P.S. (Sonoma Technology, Inc., Santa Rosa, CA (USA)). Sep 1983. 77p. NTIS, PC A05/MF A01.

VISTTA (Visibility Impairment due to Sulfur Transport and Transformation in the Atmosphere) is a cooperative program involving numerous government agencies, private companies, and universities and is jointly sponsored by the U.S. Environmental Protection Agency and Salt River Project. During the summer and winter of 1979, plume measurement programs were conducted near the Navajo Generating Station (NGS), at Page, Arizona. Results indicated that: (1) For the NGS plume, under most lighting and viewing conditions, NO2 dominates the blue light extinction and brown coloration due to the plume. (2) Widespread areas of elevated aerosol concentrations were documented in the Southwest due to long range transport from the Southern California area and wildfires. Other causes of regional haze are known to exist but were not documented in this study. (3) Evaluation of the chemistry, aerosol growth, and optics components of the PLUVUE plume visibility model showed predictions to be in reasonable agreement with the measurements. More uncertainty was encountered with the diffusion component. A set of nine reactions among NO, NO2, O3, SO2, OH, H2O, and O('D) was found to adequately simulate the plume chemistry for the clean dry background conditions at NGS.

12703 **(PB—83-262212) National air quality and emission trends report, 1981. Annual report 1975-81.** Hunt, W.F. Jr; Neligan, R.E.; Curran, T.C.; Frank, N.H.; Faoro, R.B. (Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards). Apr 1983. 110p. NTIS, PC A06/MF A01.

This report presents national and regional trends in air quality from 1975 through 1981 for total suspended particulate, sulfur dioxide, carbon monoxide, nitrogen dioxide, ozone and lead. Both long and short-term trends in each of the major pollutants are examined and, where appropriate, specific Statewide air quality trends. Air quality trends are also presented for both the National Air Monitoring Sites (NAMS) and other site categories. In addition to ambient air quality, trends are also presented for annual nationwide emissions. These emissions are estimated using the best available engineering calculations; the ambient levels presented are averages of direct measurement. This report introduces a new section, Air Quality Levels in Standard Metropolitan Statistical Areas (SMSA's). Its purpose is to provide interested members of the air pollution control community, the private sector and the general public with greatly simplified air pollution information. Air quality statistics are presented for each of the pollutants for all SMSA's with populations exceeding 500,000 for the years 1979, 1980 and 1981.

12704 **(PB—83-264200) Control of air pollution emissions from molybdenum roasting. Volume 2. Alternatives for control of weak sulfur dioxide emissions. Final report.** Masarky, N.H.; Delleney, R.D.; Schwitzgebel, K.; Nelson, T.P.; Glover, R.L. (Molycorp, Inc., Washington, PA (USA)). Sep 1983. 123p. NTIS, PC A06/MF A01.

This report covers the second phase of a three phase effort evaluating (1) characterization of particulate control of a molybdenum sulfide roasters, (2) assessment of sulfur dioxide abatement alternatives for nonferrous smelting and, in particular, for molybdenum roasting, and (3) pilot testing of the magnesia slurry process for sulfur dioxide control. It describes the results of a survey and evaluation of selected sulfur dioxide abatement alternatives applicable to molybdenum sulfide roasting. These processes include: Limestone FGD, dual alkali, magnesium oxide, Wellman-Lord, sulf-X, CIBA-GEIGY nitrosyl-sulfuric acid process, CIBA-GEIGY SO2 sorption-steam stripping process, Endako, Chiyoda thoroughbred 121, U.S. Bureau of Mines citrate, sodium carbonate throwaway, and dowa basic aluminum sulfate.

12705 **(PB—84-120716) Heavy-duty diesel emissions as a function of alternate fuels. Final report, 21 November 1981-30 June 1982.** Ullman, T.L.; Hare, C.T. (Southwest Research Inst., San Antonio, TX (USA)). Sep 1983. 165p. NTIS, PC A08/MF A01.

Exhaust emissions from a Mack EM6-300 heavy-duty diesel engine were characterized with five different fuels during transient and steady-state operation. A control fuel (Phillips D-2) was used for baseline emissions, and as a base stock in three alternate fuel blends containing EDS or SRC-II middle distillates or used lubricating oil. The fifth fuel tested was neat soybean oil, heated to 145 degrees. Emission measurements included HC, CO, CO2, NOx, visible smoke, particulate, IHC, aldehydes, odor (DOAS), phenols, sulfate, elemental composition, particle sizing, SOF, SOF boiling point distribution, BaP, Ames bioassay and HPLC fractionation. HC, CO, NOx and particulate emissions were similar for this engine on all fuels tested with exception of higher particulates for the soybean oil and higher NOx for the SRC-II blend. Ames response was highest for the EDS and SRC-II blends. The BaP level was highest for the soybean oil.

12706 **(PNL-SA—11774) Pollution monitoring using bees: a new service provided by honey bees.** Bromenshenk, J.J.; Thomas, J.M.; Simpson, J.C.; Bishop, M. (Montana Univ., Missoula (USA). Gordon Environmental Studies Lab.; Pacific Northwest Lab., Richland, WA (USA)). Oct 1983. Contract AC06-76RL01830. 8p. (CONF-8311128—1). NTIS, PC A02/MF A01. Order Number DE84003260.

From Washington State Beekeepers Association meeting; Mt. Vernon, WA, USA (2 Nov 1983).

The objectives are to provide a tool for assessing pollutant distributions and the effects of pollutants on living systems. The potential of bees as pollution monitors was studied by examining bees exposed to toxic metals near a smelter in Montana and bees in the area surrounding a hazardous waste disposal site near Puget Sound, Washington. Levels of toxic metals in the bees and brood survival were examined. It was concluded bees were, indeed, suitable indicators of pollution levels. (ACR)

12707 **(UCID—19985) Preliminary report on the global transport model GRANTOUR.** Walton, J.J.; MacCracken, M.C. (Lawrence Livermore National Lab., CA (USA)). Jan 1984. Contract W-7405-ENG-48. 27p. NTIS, PC A03/MF A01. Order Number DE84005596.

This is a preliminary description of a two-dimensional (latitude and longitude) trace species transport model (GRANTOUR) that is driven by windfields generated by the Oregon State General Circulation Model (GCM). The code uses constant mass air parcels referred to as Lagrangian Sampling Parcels (LSP) that are advected by prescribed windfields. Each parcel consists of a vertical column having one surface level and three atmospheric levels and contains up to five constituents, presently four particle size ranges and one gaseous trace species. Vertical processes such as particle settling, convection, rainout and deposition take place within each parcel. Diffusion between parcels may also be prescribed. There may also be sources and sinks driving concentrations in the parcels. This report will concentrate on the manner in which the various processes are implemented by means of the LSP method, and will present sample calculations. 9 references, 4 figures, 5 tables.

12708 **Technique for elevated release of sulfur hexafluoride tracer.** Whiteman, C.D.; Glover, D.W. (Pacific Northwest Lab., Richland, WA). *Journal of the Air Pollution Control Association;* **33**: No. 8, 772-774(Aug 1983).

Study of the dispersion of atmospheric pollutants has benefited greatly in the past from the use of artificial tracers. The study described in this paper used tethered balloons which carry one end of a hose aloft, through which a gaseous tracer can be dispensed. From the field tests it was concluded that the tandem balloon system is useful in atmospheric tracer experiments where a single balloon has insufficient lift to provide a release at the desired elevation. The SF_6 release system proved to be portable, easy to use, and suitable for simulating continuous elevated pollutant releases. 3 figures. (DP)

12709 **Comparison of air pollutant emissions from vaporizing and air atomizing waste oil heaters.** Hall, R.E.; Cooke, W.M.; Barbour, R.L. (Environmental Protection Agency, Research Triangle Park, NC). *Journal of the Air Pollution Control Association;* **33**: No. 7, 683-687(Jul 1983).

Information presented in this paper is directed to individuals concerned with emissions from combustion of waste crankcase oil for space heating. Studies were performed to characterize gaseous and particulate emissions and vaporizing pot solid residues resulting from the combustion of waste crankcase oil. Two types of waste oil burners were tested. One was a vaporizing oil burner rated at 35.2 kW (120000 Btu/h heat input), and the other was an air atomizing oil burner rated at 73.3 kW (250000 Btu/h heat input). Except for NO/sub x/ and SO/sub x/ gaseous emissions were similar to those from conventional distillate oil combustion. N0/sub x/ and SO/sub x/ emissions were higher due to higher fuel nitrogen and sulfur concentrations. Waste oil from automotive use showed higher inorganic levels than crankcase oil used for truck engine lubrication. Both burner types discharged high levels of metallic species, but the air atomizing unit had much higher stack emission levels than did the vaporizing pot system. Also, particulate loading levels were an order of magnitude higher for the air atomizing burner than for the vaporizing pot burner when firing the waste oils. However, the vaporizing pot burner generated a waste residue containing the majority of its elemental emissions. Elements which exceeded threshold limit values for one or both heaters were cadmium, chromium, cobalt, copper, iron, lead, nickel, phosphorus, and zinc. However, the nickel and much of chromium appeared to be a sampling artifact caused by the stainless steel sampling system.

12710 **Nitrogen fixation by lightning activity in a thunderstorm.** Drapcho, D.L.; Sisterson, D.; Kumar, R. (Argonne National Lab., IL). *Atmospheric Environment;* 17: No. 4, 729-734(1983).

NO and NO_2 produced in the atmosphere by lightning have been observed and measured. Detailed observations of NO/sub x/ concentrations and storm activity have been recorded. In the presence of ozone at ~ 30-50 ppb, the NO produced is rapidly oxidized to NO_2. The NO/sub x/ resulting from an individual flash of lightning, as wells as from numerous area-wide lightning flashes have been measured. It is estimated that, at least in the observed storm, a flash of lightning produced 4 x 10^{26} molecules of NO/sub x/, with an uncertainty of from one-fourth to twice that amount.

12711 **Anthropogenic influences on the global atmospheric chemistry and climate.** Wuebbles, D.J. (Lawrence Livermore Lab., CA). pp 737 of 5th Miami international conference on alternative energy sources. Vezirogla, T.N. (ed.). Coral Gables, FL; Univ. of Miami (1983). (CONF-821213—). Contract W-7405-ENG-48.

From 5. international conference on alternative energy source; Miami Beach, FL, USA (13 Dec 1982).

5003 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 11609, 12429, 12699, 12750

12712 **(BNL—51697) 1982 environmental monitoring report.** Day, L.E.; Naidu, J.R. (eds.). (Argonne National Lab., IL (USA)). Apr 1983. Contract AC02-76CH00016. 65p. NTIS, PC A04/MF A01. Order Number DE84005625.

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The environmental levels of radioactivity and other pollutants found in the vicinity of BNL during 1982 are summarized in this report. As an aid in the interpretation of the data, the amounts of radioactivity and other pollutants released in airborne and liquid effluents from Laboratory facilities to the environment are also indicated. The environmental data include external radiation levels; radioactive air particulates; tritium concentrations; the amounts and concentrations of radioactivity in and the water quality of the stream into which liquid effluents are released; the concentrations of radioactivity in biota from the stream; the concentrations of radioactivity in and the water quality of ground waters underlying the Laboratory; and concentrations of radioactivity in milk samples obtained in the vicinity of the Laboratory. 30 references, 9 figures, 18 tables.

12713 **(BNL—51724) 1981 environmental monitoring report.** Naidu, J.R.; Olmer, L.L. (eds.). (Brookhaven National Lab., Upton, NY (USA)). Apr 1982. Contract AC02-76CH00016. 67p. NTIS, PC A04/MF A01. Order Number DE84005628.

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The environmental levels of radioactivity and other pollutants found in the vicinity of BNL during 1981 are summarized in this report. As an aid in the interpretation of the data, the amounts of radioactivity and other pollutants released in airborne and liquid effluents from Laboratory facilities to the environment are also indicated. The environmental data includes external radiation levels; radioactive air particulates; tritium and iodine concentrations; the amounts and concentrations of radioactivity in and the water quality of the stream into which liquid effluents are released; the concentrations of radioactivity in sediments and biota from the stream; the concentrations of radioactivity in and the water quality of ground waters underlying the Laboratory; and concentrations of radioactivity in milk samples obtained in the vicinity of the Laboratory. 28 references, 9 figures, 20 tables.

12714 **(CONF-801186--2) Use of cryogenic air sampling in the spectroscopy of airborne gamma-ray emitters.** Perdue, P.T.; Haywood, F.F. (Oak Ridge National Lab., TN (USA)). 1980. Contract W-7405-ENG-26. 10p. NTIS, PC A02/MF A01. Order Number DE84004388.

From International conference on low-level activity measurement: low activities; Strbske Pleso, Czechoslovakia (24 Nov 1980).

Wet air can be sampled over a period of four to twelve hours and, with a transfer into a special Marinelli-dewar, can be counted in a spectrometer for several hours. The present minimum detectable amount is about 4 Bq/m^3 for 222-radon and 220-radon with liquid air in the counting dewar equivalent to one cubic meter of ambient air. The amount of ambient air sampled can be determined from ambient pressure, temperature, and absolute humidity determinations. Standard meteorological tables are used to determine the weight of ambient air in grams/litre. This quantity divided into the new weight of liquid yields the total litres of ambient air sampled. Tests run so far with 85-krypton indicate that the noble fission gases behave in a manner similar to radon, allowing measurements of stack gases, reactor plumes, etc. The minimum detectable quantity of 85-krypton appears to be about 300 Bq/m^3, depending upon the 222-radon and 220-radon content of the air. This will be the subject of a separate paper.

12715 **(ENICO—1142) Integrated method for the determination of iodine isotopic ratios near a nuclear facility.** Rankin, R.A.; Hohorst, F.A.; Nielsen, R.A.; Filby, E.E.; Emel, W.A. (Exxon Nuclear Idaho Co., Inc., Idaho Falls (USA)). Sep 1983. Contract AC07-79ID01675. 25p. (CONF-830814—10). NTIS, PC A02/MF A01. Order Number DE84005375.

From 186. national meeting of the American Chemical Society; Washington, DC, USA (28 Aug 1983).

The nuclear industry has long been concerned with the measurement of small amounts of ^{129}I that are released to the environment from reactor operations and fuel reprocessing activities. Recent developments in negative surface ionization technology at the Idaho National Engineering Laboratory have enabled the development of an integrated technique to measure isotopic ratios of iodine in air. Iodine-129 detection limits in the femtogram range have been reached with total sample sizes on the order of 1 nanogram. This report outlines the recent developments in the method and describe a laboratory simulation of environmental measurements. Included in the report are: accuracy and precision data for in-house generated standards, a description of a sampling fractionation study, and a final test of the method in measuring air samples collected at the Idaho Chemical Processing Plant.

12716 **(INPE—2473) Measurement X radiation > 30 KeV in the Brazilian magnetic anomaly with omnidirectional detectors.** Pinto Junior, O.; Gonzalez-Alarcon, W.D.; Gonzalez, A.L.C. de; Martin, I.M.; Dutra, S.L.G.; Pinto, I.R.C.A.; Pereira, A.E.C.; Senador, R. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)). Jul 1982. 14p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703866.

Atmospheric X-Rays measurements, with energies > 30 KeV, were performed at Sao Jose dos Campos-Brazil (23°S, 46°W Geographic) on April 14 and December 19, 1981, using omnidirectional NaI (Tl) scintillation counters on board stratospheric balloons. The main purpose of these measurements is to study the dynamics of precipitating electrons at the Brazilian Magnetic Anomaly. Studies on similar measurements during the previous decade seemed to show the existence of approximately 100 KeV precipitating electrons, possibly related to a coulomb scattering with the atmosophere. The studies on the recent measurements try not only to confirm such indications, but also to show further features of the dynamics of precipitating electrons, mainly during magnetically active time intervals. During such intervals, more energetic electrons (up to approximately 1000 KeV) also seem to precipitate, probably due to resonant wave-particle interactions at the low latitude inner magnetosphere. The collected data during the recent measurements seem to indicate the existence of such interactions.

12717 **(NUREG—0837-Vol.3-No.2) NRC TLD direct radiation monitoring network. Progress report, April-June 1983.** Costello, F.; Thompson, T.; Cohen, L.; Taylor, M. (Nuclear Regulatory Commission, King of Prussia, PA (USA). Region I). Dec 1983. 139p. NTIS, PC A07/MF A01 - GPO. Order Number DE84900671.

The US Nuclear Regulatory Commission (NRC) Direct Radiation Monitoring Network is operated by the NRC in cooperation with participating states to provide continuous measurement of the ambient radiation levels around licensed NRC facilities, primarily power reactors. The Network is intended to measure radiation levels during routine facility operations and to establish background radiation levels used to assess the radiological impact of an unusual condition, such as an accident. This report presents the radiation levels measured around all facilities in the Network for the second quarter of 1983. A complete listing of the site facilities monitored is included.

12718 **(RISO-R—481) Tracer investigation of the atmospheric dispersion in the Dyrnaes Valley, Greenland. A study under the Uranium Project, performed by Risoe National Laboratory and the Air Pollution Laboratory of the National Agency of Environmental Protection.** Gryning, S.E.; Lyck, E. (Risoe National Lab., Roskilde (Denmark)). Feb 1983. 67p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE83703867.

Mining at Kvanefjeld, Greenland, will result in releases of air pollution gases. In order to measure the dilution of these gases tracer experiments were carried out in July-August 1981. Results from these experiments are described. The Kvanefjeld constitutes the northwestern side of a valley. The tracer was released at the Kvanefjeld during the night and sampled in the valley. The measured tracer concentrations were compared with those calculated by use of a conventional model of the dispersion of plumes. The dilution of the tracer was found to correspond to the dilution at ground level of a plume from a stack of 100-200 m height in atmospheric neutral conditions (wind speed 5 m/s). General aspects of the flow-field in the valley are discussed. It was observed that the flow direction in the valley shifts between downvalley and upvalley with a period of approximately 1 hour. It is suggested that this behaviour is caused by the interplay of a drainage flow and a sea-breeze.

12719 **(SAND—82-2417) Method of approximating the effects of blast mitigation materials on particulate-containing clouds formed by explosions.** Dyckes, G.W. (Sandia National Labs., Albuquerque, NM (USA)). Sep 1983. Contract AC04-76DP00789. 40p. NTIS, PC A03/MF A01. Order Number DE84001612.

A numerical model was developed for predicting the effect of blast mitigation materials on the rise and entrainment rate of explosively driven buoyant clouds containing radiotoxic particles. Model predictions for clouds from unmitigated explosions agree with published observations. More experimental data are needed to assess the validity of predictions for clouds from mitigated explosions.

5004 Thermal Effluents Monitoring And Transport

12720 **(NP—4770079) Models of heat island flow by convective plumes.** Faust, K.M. (Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Bauingenieur- und Vermessungswesen). 17 Jul 1981. 154p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84770079.

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The effect of an urban heat island on the climate and air quality of the local environment has been investigated. Within cities a number of cellular convective flow patterns are observed which give rise to plume-like motions with very low initial momentum. The flow process for an individual cell is described using a convective plume model. In the theoretical analysis the flow field is divided into three parts: the convective boundary layer, the buoyant plume and penetrative convection at the inversion layer. Heat transfer conditions within the boundary layer at the ground determine the plume boundary conditions. An improved integral plume model is presented which specifically accounts for the turbulent mixing processes using a generalized entrainment function. Numerical analysis of the model yields the temperature and velocity field as functions of bottom heat flux, heat island size and initial vertical temperature profile. As the heat island flow process is typically instationary the time-dependence of the ambient boundary conditions must be included. This time-dependence is influenced by interfacial mixing due to penetration of thermals into the stable stratification or inversion layer. A constant entrainment coefficient has been used to describe this mixing process. Previously published experimental data from other authors are used to calibrate the theoretical model which was then verified by laboratory experiments in water. Good agreement between model prediction and experimental results were found. The model can also be applied to special cases such as unstratified environments or buoyant plumes.

5005 Site Resource And Use Studies

12721 **(PB—83-256925) Study of the origin and fate of air pollutants in California's great central valley: aerometric monitoring. Final report 1978-79.** Schwall, R.J. (Rockwell International Corp., Newbury Park, CA (USA). Environmental Monitoring and Services Center). 6 May 1981. 159p. NTIS, PC A08/MF A01.

This report describes the aerometric and meterological monitoring performed over three seasons during 1978 and 1979. This monitoring was part of an overall tracer transport study. Three air monitoring trailers were deployed during each of the three intensive study periods to measure: oxone, oxides of nitrogen, sulfur dioxide, carbon monoxide, hydrocarbons, wind speed and temperature. In November and December of 1978 the trailers were located at Lost Hills, Reedley and 26 kilometers south-south-east of Bakersfield. During June through August 1979 the systems were located east of Modesto, Merced, and Madera. During August through October the trailers were located at Reedley, Arvin and Lost Hills.

5006 Regulations

REFER ALSO TO CITATION(S) 12205, 12701, 12748, 12749

12722 **(PB—83-250779) Atmospheric emergencies: existing capabilities and future needs.** Smith, A.J. Jr; van Cleave, H.D.; Wada, R.Y.; Munger, B.; Hurt, P. (Transportation Research Board, Washington, DC (USA)). 1983. 48p. NTIS, PC A03/MF A01.

The 11 papers in this report deal with the following areas: environmental emergencies: preparing for critical hours; national overview of emergency response under superfund; atmospheric problems from hazardous materials spills in San Francisco bay area; integrated modeling of the release and dispersion of hazardous gases in the atmosphere; U.S. Air Force air weather service methodologies for calculating toxic corridors; calculation of evacuation distances during toxic air pollution incidents; toxic corridor prediction programs; toxic corridor projection models for emergency response; radiation hazards analysis in transport of low specific activity waste material; aerometric instrumentation for real-time monitoring at hazardous spill sites: overview of needs and resources; and, applications of remote sensing to hazardous spill incidents.

12723 **(PB—83-264440) Assessment of the adequacy of the Appendix F quality assurance procedures for maintaining CEMS (continuous emission monitoring systems) data accuracy (Status report No. 1). Final report.** (Entropy Environmentalists, Inc., Research Triangle Park, NC (USA)). Sep 1983. 80p. NTIS, PC A05/MF A01.

This report summarizes the first year's audit results of Continuous Emission Monitoring Systems (CEMS) installed at scrubber-equipped power plants. The audits were conducted to support a draft quality assurance appendix for 40 CFR 60 entitled 'Quality Assurance Procedures for Gas CEMS Used for Compliance'. The procedures call for a quality performance audit of the CEMS using certified cylinder gas or reference method tests. Audit data have been collected for sulfur dioxide, nitrogen oxides, oxygen and carbon dioxide. EDC, Contraves, Lear Seigler and DuPont CEMS have been audited, with the results indicating the need for frequent audits with effective corrective action to be taken when excessive inaccuracies are measured.

12724 **Regional air quality in Four Corners study region.** Nochumson, D.H. (Los Alamos National Lab., NM). *Journal of the Air Pollution Control Association;* 33: No. 7, 670-677(Jul 1983).

The results from the regional air quality analysis for the Four Corners Study are discussed in the paper. The study was one of five regional studies conducted for the National Commission on Air Quality. Potential regional air quality impacts were evaluated through the year 1995 for alternative energy scenarios under current and alternative regulatory policies. The alternative regulatory policies include emission fees, technology standards, emission ceilings, and prevention of significant deterioration class elimination. The alternatives were compared in terms of their impacts on regional visibility and on the ambient concentrations of SO_2, SO_4, and primary fine particulates. The fate of the pollutants was estimated. The alternative regulatory policies were quite different with respect to their control of SO/sub x/ emissions and their impacts on regional visibility. Sources located outside of the study region were estimated to have a major impact on regional air quality within the study region.

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL

5101 Basic Studies

12725 **(INS-R—304) Purification and measurement of acid leachable europium in sands as an aid in the study of sediment transport.** Ditchburn, R.G.; McCabe, W.J. (Department of Scientific and Industrial Research, Lower Hutt (New Zealand). Inst. of Nuclear Sciences). May 1982. 5p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704331.

The use of europium labelled sand as an aid in the study of sediment transport has been suggested. A method for the purification of acid leachable europium is described. The final measurement is made by flame emission spectrometry using a nitrous oxide-acetylene flame. The usefulness of the method is limited by the natural levels of europium which, in the sand studied, was around 0.3 ppm.

5102 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 11442, 11527, 12130, 12698, 12735, 12857, 12858

5103 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 11609, 11643, 11645, 11646

5105 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 11590, 11608, 11614, 11615, 11620

12726 **(AD-A—132483/9) Treatment of landfill leachate at army facilities. Final report.** Shafer, R.A.; Smith, E.D.; Bandy, J.T.; Malone, P.G.; Moore, D.A. (Army Construction Engineering Research Lab., Champaign, IL (USA)). Aug 1983. 132p. NTIS, PC A07/MF A01.

The overall objectives of this research are (1) to supply information allowing Facility Engineers (FEs) at Army installations both to recognize potential or actual leachate problems and to gauge the magnitude of the problems, (2) to provide guidance on short- and long-term remedial actions which might control leachate formation and migration, and (3) to provide information to installation, FE, major command, and district personnel regarding legal ramifications of and responsibilities concerning leachate gas/problems. The objective of the phase of the study reported here is to provide FEs (1) an overview of the technologies that can be used to treat leachate, and (2) guidance on choosing and designing leachate treatment systems that will meet the Army's needs. An extensive literature survey identified technologies which have been used to treat leachate, or have shown potential for treating waste with characteristics similar to leachate. Technologies were examined in terms of their operational principles, waste treatment capability, major design and construction parameters, advantages and disadvantages, and estimated costs. Particular emphasis was given to lagoon technology because it has low capital, operation, and maintenance costs, and it is a form of biological treatment which has shown the most potential for treating typical Army leachates.

12727 **(PB—83-239012) Ecological models of the Mississippi Deltaic Plain Region: data collection and presentation.** Costanza, R.; Neill, C.; Leibowitz, S.G.; Fruci, J.R.; Bahr, L.M. Jr. (Louisiana State Univ., Baton Rouge (USA). Coastal Ecology Lab.). Mar 1983. 362p. NTIS, PC A16/MF A01.

This technical report consists of quantified ecosystem models with input-output matrices of the biology, hydrology, geology, and socioeconomics of the major habitats of the Mississippi Deltaic Plain Region. The quantitative framework characterizes the region and provides a data base for future ecological models. The habitats modeled are aggregated from those previously identified. Detailed descriptions of the biological, physical, and socioeconomic interconnections within this coastal ecosystem allow coastal managers and decision makers to better assess the impacts of human activity on the region's natural resources. It is hoped that future modeling attempts based on the data collected in this report will help predict human impacts on coastal ecosystems and aid in the arduous task of assessing tradeoffs between nonrenewable resource development and renewable resource preservation.

12728 **(PB—83-251629) Field assessment of site closure, Boone County, Kentucky. Final report, August 1979-June 1981.** (EMCON Associates, San Jose, CA (USA)). Aug 1983. 73p. NTIS, PC A04/MF A01.

The current project was undertaken before the scheduled site closure to obtain information useful to designers of future landfill facilities. Information was developed on cover soils, refuse, leachate collection systems, lining materials, and contaminant migration from the test cells. To examine and recover cell components, exploratory excavations were made through the refuse and base liners. Each of the cell elements (cover, refuse, liners, etc.) were thoroughly documented, and samples underwent extensive testing. The project included the recovery and detailed inspection of clay and synthetic liners that had been exposed to leachate for approximately 9 years. Both field and laboratory testing showed that little degradation of the liner materials had occurred during these years of service.

12729 **(PB—83-253534) Love Canal monitoring program. Volume 1. Final report.** (GCA Corp., Bedford, MA (USA). GCA Technology Div.). Jul 1983. 218p. NTIS, PC A10/MF A01.

This report summarizes the prime contractor activities during the monitoring phase of the Love Canal project. Since GCA Corporation was only responsible for data collection, no analytical results appear in this report. The program involved a multifaceted sampling and analytical effort designed to detect and quantify a variety of trace metals, volatile organics, pesticides and other compounds in soil, sediment, air, biota, and water samples. The principal purpose of these activities was to provide data with which EPA could assess the extent of environmental contamination in the Love Canal Area. Since the area declared as a National Emergency was extended from those homes directly surrounding the Love Canal dumpsite to a more general area on May 21, 1980, it had been determined that the overall exposure of residents must be established as quickly as possible. The program, therefore, was on an extremely tight schedule with field sampling activities to be completed by October 31, 1980. GCA organized its efforts into seven technical elements, each of which is discussed.

5106 Regulations

REFER ALSO TO CITATION(S) 12131

52 ENVIRONMENTAL SCIENCES, AQUATIC

5201 Basic Studies

12730 **(DPST—83-307) Water level measurement network computer file.** Krapp, C.W.; McClain, L.D. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). 25 Aug 1982. Contract AC09-76SR00001. 20p. NTIS, PC A02/MF A01. Order Number DE84005388.

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A computer system has been developed to manage the water level measurement network used for hydrologic studies of specific plant areas and the region. Water level data for 150 wells has been entered with a time span ranging from one to 20 years of monthly measurements. Using the flexibility of the Statistical Analysis System (SAS), the data can be retrieved in tabular or in graphical form. This system has been in use since 1979 and is updated routinely by technicians. Approximately, two man months of effort have been required for program design, data entry, and current revisions.

12731 **(FWS/OBS—82/65) Turtles, birds, and mammals in the northern Gulf of Mexico and nearby Atlantic waters. An overview based on aerial surveys of OCS areas, with emphasis on oil and gas effects.** Fritts, T.H.; Irvine, A.B.; Jennings, R.D.; Collum, L.A.; Hoffman, W.; McGehee, M.A. (New Mexico Univ., Albuquerque (USA). Museum of Southwestern Biology). Jul 1983. 480p. Minerals Management Service, Dept of the Interior, Washington, DC 20240.

Aerial line transect surveys of marine turtles, birds, and mammals were conducted in four areas of the Gulf of Mexico and nearby Atlantic waters. Areas surveyed were 111 km by 222 km and located off Brownsville, Texas; Marsh Island, Louisiana; Naples, Florida; and Merritt Island, Florida. Data on distribution, abundance, seasonal occurrence, and habitat use are reported in accounts for each of the 88 species observed. Information on reproduction, behavior, and potential impacts of Outer Continental Shelf (OCS) development are also discussed. Later chapters summarize the fauna of each of the four areas; characterize the inshore, nearshore, and offshore fauna; and discuss the effects of OCS development on marine vertebrates. 460 references, 167 figures, 65 tables.

12732 **(FWS/OBS—83/01) Ecology of Albemarle Sound, North Carolina: an estuarine profile.** Copeland, B.J.; Hodson, R.G.; Riggs, S.R.; Easley, J.E. Jr. (North Carolina State Univ., Raleigh (USA); East Carolina Univ., Greenville, NC (USA). Dept. of Geology). Sep 1983. 82p. Information Transfer Specialist, US Fish and Wildlife Service, NASA, 1010 Gausa Blvd., Slidell, LA 70458.

Albemarle Sound, a large oligohaline estuary in northeastern North Carloina, constitutes a significant portion of North Carolina's coastal system. It is shallow, wind dominated, and strongly influenced by freshwater inflow. These conditions, combined with limited oceanic access and exchange, maintain fresh- to brackish water conditions throughout most of the estuary during the year. The nekton are the most well-known biological component of this extensive estuarine system. Albemarle Sound is an important nursery area for a number of anadromous and migratory fish as well as the blue crab and supports fisheries for many of these species. Other biological components (phytoplankton, zooplankton, and benthos) in the estuary are less well studied. Declining fisheries, algal blooms in freshwater tributaries, and changing patterns of land and water use are among the critical issues facing managers of Albemarle Sound. This report discusses current steps being taken toward holistic management and provides a state-of-the-art information base and ecological synthesis of the estuary and its watershed. 89 references, 50 figures, 19 tables.

5202 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 11417, 11525, 11528, 11550, 12698, 12706, 12712, 12713, 12858

12733 **(DOE/EV/10610—3) Two-dimensional ocean model for climate and tracer studies.** Hoffert, M.I.; Volk, T.; Hsieh, C.T. (New York Univ., NY (USA). Dept. of Applied Science). 1982. Contract AC02-81EV10610. 30p. NTIS, PC A03/MF A01. Order Number DE84005663.

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A mathematical model is developed for the zonal-mean latitude-depth distribution of temperature, density and biogeochemical tracers in the world ocean in terms of their surface distributions and internal sources and sinks. The general formulation is applicable to both steady and transient fields; and can be used to analyze individual basins or the world ocean as a whole. It incorporates in parameterized form the major fluid mechanical transport processes of interest in physical oceanography. The transition between upper (stress-driven) and lower (uniform upwelling) zones is modeled as a discontinuity in vertical velocity at some intermediate water injection depth h/sub i/; but with other properties and property derivatives continuous at this interface. For the steady temperature field, 2D distributions and isotherms are obtained analytically. Model calculations for specific parameter values are presented and compared with observations of oceanic poleward heat transport, surface wind-stress and zonal-mean isotherms, and show overall agreement with these features on a planetary scale. Application of the model to calculations of transient climate change by coupling to an energy balance climate model is discussed; also treated are applications to modeling two-dimensional steady-state and transient distributions of inorganic carbon, oxygen, nutrients, alkalinity, radiocarbon and tritium. 41 references, 5 figures.

12734 **(DOE/EV/70040—27) Hydrocarbon studies in Puget Sound and off the Washington Coast. Final report of progress, March 1976-September 1983.** Carpenter, R. (comp.). (Washington Univ., Seattle (USA). School of Oceanography). Sep 1983. Contract AT06-76EV70040. 17p. NTIS, PC A02/MF A01. Order Number DE84005642.

This report summarizes seven year's progress in our studies of the amounts, types and probable origins of aliphatic, aromatic, S- and N-containing hydrocarbons in sediments, organisms and waters of Puget Sound and the Washington coast. We identified the relative importance of the various possible sources of these substances, the major pathways by which they are transferred through some parts of the marine food web, their rates of transfer, their possible transformations into other chemical forms, and their ultimate fates. We have found that changes in aliphatic, aromatic and N-containing hydrocarbons are evident with depth in most ^{210}Pb-dated sediment cores. These changes are due both to natural diagenetic processes and to low level inputs of fossil hydrocarbons from a variety of energy related activities. The greatest polynuclear aromatic hydrocarbon fluxes are to central Puget Sound sediments near the major urban areas, rather than in northern Puget Sound near the major refineries. We have found S-containing hydrocarbons in Puget Sound sediments which are largely due to natural sources. In contrast, N-containing hydrocarbons in surface sediments appear largely due to anthropogenic inputs, probably from atmospheric dusts rich in these compounds from combustion processes. The N-containing azarenes are especially enriched in deeper layers of sediment containing coal particles and may turn out to be good indicators of unburned coal contamination of sediments. Studies of the role of zooplankton fecal pellets in the cycling of trace chemicals in the sea have shown that fecal pellets are an important vertical transport agent for hydrocarbons. The planktonically-derived hydrocarbons are degraded faster than the terrestrially derived ones, while the polynuclear aromatic hydrocarbons are not noticeably degraded in the same time period. 26 references, 5 figures.

12735 **(UCRL—53426) Potential for saturated groundwater system contamination at the Lawrence Livermore National Laboratory.** Stone, R.; Ruggieri, M.R.; Rogers, L.L.; Emerson, D.O.; Buddemeier, R.W. (Lawrence Livermore National Lab., CA (USA)). 14 Dec 1982. Contract W-7405-ENG-48. 111p. NTIS, PC A06/MF A01. Order Number DE84005631.

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A program of hydrogeologic investigation has been carried out to determine the likelihood of contaminant movement to the saturated zone from near the ground surface at Lawrence Livermore National Laboratory (LLNL). A companion survey of potential contaminant sources was also conducted at the LLNL. Water samples from selected LLNL wells were analyzed to test the water quality in the uppermost part of the saturated zone, which is from 14 to 48 m (45 to 158 ft) beneath the surface. Only nitrate and tritium were found in concentrations above natural background. In one well, the nitrate was slightly more concentrated than the drinking water limit. The nitrate source has not been found. The tritium in all ground-water samples from wells was found far less concentrated than the drinking water limit. The extent of infiltration of surface water was traced with environmental tritium. The thickness and stratigraphy of the unsaturated zone beneath the LLNL, and nearby area, was determined with specially constructed wells and boreholes. Well hydrograph analysis indicated where infiltration of surface water reached the saturated ground-water system. The investigation indicates that water infiltrating from the surface, through alluvial deposits, reaches the saturated zone along the course of Arroyo Seco, Arroyo Las Positas, and from the depression near the center of the site where seasonal water accumulates. Several potential contaminant sources were identified, and it is likely that contaminants could move from near the ground surface to the saturated zone beneath LLNL. Additional ground-water sampling and analysis will be performed and ongoing investigations will provide estimates of the speed with which potential contaminants can flow laterally in the saturated zone beneath LLNL. 34 references, 61 figures, 16 tables.

12736 **The sea surface microlayer: biology, chemistry and anthropogenic enrichment.** Hardy, J.T. (Batelle, Marine Research Lab., Sequim, WA). *Progress in Oceanography;* 11: 307-328(1982). Contract AC06-76RL01830.

Recent studies increasingly point to the interface between the world's atmosphere and hydrosphere (the sea-surface microlayer) as an important biological habitat and a collection point for anthropogenic materials. Newly developed sampling techniques collect different qualitative and quantitative fractions of the upper sea surface from depths of less than one micron to several centimeters. The microlayer provides a habitat for a biota, including the larvae of many commercial fishery species, which are often highly enriched in density compared to subsurface water only a few cm below. Common enrichments for bacterioneuston, phytoneuston, and zooneuston are 10^2-10^4, 1-10^2, and 1-10, respectively. The trophic relationships or intergrated functioning of these neustonic communities have not been examined. Surface tension forces provide a physically stable microlayer, but one which is subjected to greater environmental and climatic variation than the water column. A number of poorly understood physical processes control the movement and flux of materials within and through the microlayer. The microlayer is generally coated with a natural organic film of lipid and fatty acid material overlying a polysaccharide protein complex. The microlayer serves as both a source and a sink for materials in the atmosphere and the water column. Among these materials are large quantities of anthropogenic substances which frequently occur at concentrations 10^2-10^4 greater than those in the water column. These include plastics, tar lumps, polyaromatic hydrocarbons, chlorinated hydrocarbons, and potentially toxic metals, such as, lead, copper, zinc, and nickel. How the unique processes occurring in the microlayer affect the fate of anthropogenic substances is not yet clear.

5203 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 11603, 11617, 11620, 11627, 11630, 11645, 11647, 11648, 11649, 11650, 11653, 12353, 12430, 12712, 12713, 12745, 12746, 12750

12737 **(CEA-R—5227) Experimental study on the possibilities of direct transfer of caesium 137 from sediment to the carps (Cyprinus carpio L.).** Lambrechts, A.; Foulquier, L. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France)). Jun 1983. 81p. (In French). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84750408.

The exchanges of caesium 137 with the Rhone river water and deposits and its direct transfer from water and deposits to the carp are studied. The sediments have a high retention capacity for radiocaesium associated with fine particles and certain clays (illite). Caesium desorption from sediment to water is always very weak (less than 5% of the initial activity of the sediments; it varies with the agitation and salinity of the water. The transfer of caesium from the water to the carps is characterized by a regular increase of activity in the fish. After 63 days of experimentation, equilibrium has not been reached, the carp have retained only 1% of the water activity, and their concentration factor is about 4. The transfer of caesium from sediment to the fish is weak but regular. After 79 days of experimentation, equilibrium has not been reached. Less than 1% of the sediments activity is found in the fish; the transfer factor is about 10^{-2}. Because of the high content of caesium 137 in sediments, the activity of the carp is increased and the concentration factor, calculated in relation to the surface water, is greater than 60.

12738 **(CEA-R—5233) Distribution and behaviour of transuranic elements in the physical and biological compartments of the Channel French shore.** Germain, P.; Miramand, P.; Camus, H.; Grenaut, C. (CEA Centre de La Hague, 50 - Cherbourg (France)). Sep 1983. 33p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84750465.

Biological samples (algae, suspension-feeder mollusks living in contact with sediments, annelids), sediments and sea water were taken at 5 stations along the Channel shore from 1978 to 1981 in order to determine $^{239}+^{240}Pu$, ^{238}Pu, ^{241}Am and ^{244}Cm levels. In Northern Cotentin, radioactivity levels for $^{239}+^{240}Pu$, ^{238}Pu and ^{241}Am, were respectively about 1-10, 0.5-7 and 1-19 pCi kg^{-1} fresh weight in biological samples; 24-90, 11-28 and 24-31 pCi kg^{-1} dry weight in sediments; 1-7, 5-40 and 2-15 fCi l^{-1} in sea water. For stations far from the La Hague outlet (Seine river and Mont Saint-Michel bays) levels for $^{239}+^{240}Pu$, ^{238}Pu and ^{241}Am were respectively about 0.3-5, 0.1-2 and 0.2-3 pCi kg^{-1} fresh weight in biological samples; 30-80, 5-26 and 14-40 pCi kg^{-1} dry weight in sediments and 1-3, 3-4 and 3-8 fCi l^{-1} in sea water. Labelling of industrial wastes was demonstrated by the values of the $^{238}Pu/^{239}+^{240}Pu$ ratios. The evolution of plutonium isotopes in sea water and in the other environmental compartments and the bioavailability of americium are discussed. Sediment-animal transfers are quantified and their processes specified. An assessment of plutonium and americium hazards from ingestion of mollusks shows that the ingested activity represents 1.1 10^{-4} only of the ALI (ingestion) recommended by ICRP for members of the public.

12739 **(DOE/EV/10694—9) Radioelement studies in the oceans. Final report, 15 April 1981-14 September 1983.** Cochran, J.K.; Livingston, H.D.; Sholkovitz, E.R. (Woods Hole Oceanographic Institution, MA (USA)). Sep 1983. Contract AC02-81EV10694. 21p. NTIS, PC A02/MF A01. Order Number DE84005449.

Significant advances into the post-depositional (or diagenetic) chemistry of radionuclides have been made by developing a method to study the pore water chemistry of $^{239,240}Pu$, ^{137}Cs, ^{55}Fe, and several natural radionuclides (U, Th, Ra, ^{210}Po, ^{210}Pb). Field (box coring) and laboratory studies demonstrate that $^{239,240}Pu$ has an insignificant diagenetic mobility in nearshore sediments. ^{137}Cs, in contrast, appears to be significantly mobile and undergoes rapid ion-exchange reactions, while U has an active redox-complexation sediment chemistry. A major emphasis has been on Windscale nu-

clear fuel reprocessing radionuclide studies in the Irish Sea, Minch, North Sea, and Norwegian and Greenland Seas. This work has demonstrated the dramatic penetration of these radionuclides (especially ^{137}Cs) through the Irish Sea, Minch, and North Sea into the upper 1000 m of the Norwegian and Greenland Seas. Measurements of ^{137}Cs, ^{134}Cs, and ^{90}Sr from samples collected in the Arctic and North Atlantic Oceans during Transient Tracers in Oceanography (TTO) cruise in 1981 provide a valuable and unique set of data to the tracer studies in the North Atlantic Ocean.

5204 Thermal Effluents Monitoring And Transport

REFER ALSO TO CITATION(S) 12733

12740 **(NUREG/CR—3446) Ecological studies of wood-boring bivalves and fouling organisms in the vicinity of the Oyster Creek Nuclear Generating Station. Final report, September 1976-December 1982.** Hoagland, K.E. (Academy of Natural Sciences of Philadelphia, PA (USA). Dept. of Malacology). Oct 1983. 186p. NTIS, PC A09/MF A01 - GPO $6.00. Order Number DE84900705.

The species composition, distribution, and population dynamics of wood-boring bivalves were studied using wood test panels at 20 stations in the vicinity of the Oyster Creek Nuclear Generating Station, Barnegat Bay, New Jersey. Physiological tolerances of three teredinid species were investigated in the laboratory and correlated with field values of temperature, salinity, siltation, precipitation, and plant operations. The interaction of boring and fouling organisms was examined. There is a definite correlation between the operation of the power plant and teredinid outbreaks. Increased salinity and water flow as well as temperature are responsible. After 1976, most of the damage in Oyster Creek was done by the introduced subtropical species Teredo bartschi. It can respond faster than native species to environmental change. Although Oyster Creek contributed larvae to neighboring parts of Barnegat Bay, its role as a breeding ground was limited. Some elements of the fouling community may be antagonistic to shipworm growth. Fouling was increased in both biomass and species richness in Oyster Creek when compared with creek controls, but the fouling community in Oyster Creek was less stable than that in other areas. Lower salinity limits for the teredinids were within the salinity range found in Oyster Creek but not within the range found in the control creeks. 71 references, 9 figures, 39 tables.

12741 **(PB—84-115625) Long-term benthic monitoring programs near the Morgantown and Calvert Cliffs power plants - second annual report. Volume 3. Appendices A-F. Interim report for July 1980-June 1982.** Holland, A.F.; Hiegel, M.H.; Hoffman, H.; Stroup, C.F. (Martin Marietta Corp., Baltimore, MD (USA). Environmental Center). Aug 1983. 368p. NTIS, PC A16.

This report summarizes the findings of a long-term study of the benthic biota of the mesohaline regions of the Potomac estuary and the Maryland portion of the mainstem of the Chesapeake Bay. The primary objective of the program was to determine if power plant operations had measurable effects on benthic resources over time periods greater than 5 years. Salinity was the major environmental factor controlling regional benthic distributions and sediment properties were the major environmental factor contributing to local distributions. Seasonal fluctuations in abundance and biomass were the largest source of variation for most species. Higher standing stocks and more successful recruitment of several benthic populations occurred at thermally affected locations than at reference areas.

12742 **(UBA-FB—80-012) Water quality indices for thermal inputs from cooling tower plants.** Rincke, G.; Kaltenbrunner, H.F.; Rudolph, K.U. (Umweltbundesamt, Berlin (Germany, F.R.)). 1980. 166p. (In German). Available from Umweltbundesamt, Berlin (Germany, F.R.).

Thermal inputs from cooling-tower-plants may but don't necessarily have to cause river pollution. An economical and ecological reasonable input management must differ between seasons and take water quality (especially organic pollution) into account. Administration may do this by means of paragraph 36 (WHG), using a new model for thermal effects on self-purification and evaporation.

5205 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 11615, 11721

12743 **(PB—84-104231) Report to the Congress on ocean pollution, monitoring and research, October 1981 through September 1982.** (National Ocean Service, Rockville, MD (USA)). Jul 1983. 80p. NTIS, PC A05/MF A01.

This report describes the ocean pollution investigations that the National Oceanic and Atmospheric Administration (NOAA) carried out during fiscal year 1982. It covers four major categories of research activity: (1) ocean waste disposal; (2) coastal land use, hazardous waste disposal and ecosystem modification; (3) ocean resource use and accidental discharges; and (4) environmental assessment and marine management.

5206 Regulations

REFER ALSO TO CITATION(S) 12131

12744 **(PB—83-256727) Defining stream fish microhabitat requirements for water project planning. Final report.** Helm, W.T. (Utah State Univ., Logan (USA). Utah Center for Water Resources Research). Nov 1982. 18p. NTIS, PC A02/MF A01.

Environmental concerns are generating criteria for protecting stream fish habitat from flow regime changes caused by water resources development and use, but the lack of scientific basis for many of the promulgated water requirements creates grave doubts that true protection will be achieved. Economically productive water use is being prevented without assurance of environmental gain. The need for scientific habitat need characterization was addressed through the systematic collection of data on brown trout preferences in the Blacksmith Fork of the Logan River, Utah. Microhabitat components (velocity, depth, and light) were defined, measured, and mapped for a 90-meter river section. These quantified component ranges can be used for formulating habitat protection ranges that will effectively protect fish while permitting economical but harmless water development.

12745 **(PB—83-258509) Environmental management report, Region IV (pilot project): Parts 1 and 2. Final report.** (Environmental Protection Agency, Atlanta, GA (USA). Region IV). Jun 1983. 73p. NTIS, PC A04/MF A01.

This report was prepared primarily as an internal document to present to management an overview of environmental status and trends in Region IV and to highlight environmental problems and management implications. This is a part of a series of reports from each of the ten federal Regions of the United States. Discussion is organized by the several programs concerned with different aspects (media) of the environment from air quality to radiation and pesticides. This report covers the States of Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina and Tennessee.

12746 **(PB—83-258517) Environmental management report, Region IV (pilot project): Attachments A and B. Final report.** (Environmental Protection Agency, Atlanta, GA (USA). Region IV). Jun 1983. 207p. NTIS, PC A10/MF A01.

This report was prepared primarily as an internal document to present to management an overview of environmental status and trends in Region IV and to highlight environmental problems and management implications. This is a part of a series of reports from each of the ten federal Regions of the United States. Discussion is organized by the several programs concerned with different aspects (media) of the environment from air quality to radiation and pesticides. This report covers the States of Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina and Tennessee.

12747 **(PB—83-262931) Federal and state coastal management programs.** McCrea, M. (Minerals Management Service, Anchorage, AK (USA). Alaska Outer Continental Shelf Office). Mar 1983. 99p. NTIS, PC A05/MF A01.

In response to the federal Coastal Zone Management Act of 1972, most coastal states adopted comprehensive coastal management programs. Alaska's program was designed to dovetail with the federal coastal management program (CMP). The report describes the coastal management legislation and programs of the federal government and the State of Alaska. Sections of the paper which are particularly pertinent to outer continental shelf oil and gas development and the effects of the Alaska Native Claims Settlement Act and the Alaska National Interest Lands Conservation Act on coastal management are highlighted.

53 ENVIRONMENTAL-SOCIAL ASPECTS OF ENERGY TECHNOLOGIES

5301 Social And Economic Studies

REFER ALSO TO CITATION(S) 11443

12748 **(NP—4770081) Environmental pollution and community planning in Wuppertal.** Ganter, J. (Bonn Univ. (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). 21 Oct 1980. 246p. (In German). NTIS (US Sales Only), PC A11/MF A01. Order Number DE84770081.

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A pollution model is set up for the city of Wuppertal for the purpose of finding out inhowfar ecological aspects are considered in municipal planning and policy, and how planning processes are structured. The concept of ecology is extended to humans, and an analysis is made on two levels, i.e. scientific analysis and municipal policy analysis.

5302 Assessment Of Energy Technologies

REFER ALSO TO CITATION(S) 11761, 12819

12749 **(EPA—450/3-83-005a) Distillation operations in synthetic organic chemical manufacturing: background information for proposed standards.** Farmer, J.R. (Environmental Protection Agency, Research Triangle Park, NC (USA). Emission Standards and Engineering Div.). Dec 1983. 402p. NTIS, PC A18/MF A01.

Standards of Performance for the control of volatile organic compound emissions from distillation operations in the synthetic organic chemical manufacturing industry are being proposed under the authority of Section 111 of the Clean Air Act. These standards would apply to new, modified, and reconstructed distillation facilities. This document contains background information and environmental and economic impact assessments of the regulatory alternatives considered in developing proposed standards.

12750 **(NUREG—1026) Draft environmental statement related to the operation of Braidwood Station, Units 1 and 2 (Docket Nos. STN 50-456 and STN 50-457).** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Dec 1983. 211p. NTIS MF A01 - GPO $6.50. Order Number DE84900653.

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The Draft Environment Statement contains the second assessment of the environmental impact associated with the operation of Braidwood Station, Units 1 and 2, pursuant to the National Environmental Policy Act of 1969 (NEPA) and Title 10 of the Code of Federal Regulations, Part 51, as amended, of the Nuclear Regulatory Commission regulations. This statement examines the environment, environmental consequences and mitigating actions, and environmental and economic benefits and costs. Land use and terrestrial and aquatic ecological impacts will be small. Operational impacts to historic and archeologic sites will be negligible. The effects of routine operations, energy transmission, and periodic maintenance of rights of way and transmission facilities should not jeopardize any populations of endangered or threatened species. No significant impacts are anticipated from normal operational releases of radioactivity. The risk of radiation exposure associated with accidental release of radioactivity is very low. The net socioeconomi effects of the project will be beneficial. On the basis of the analysis and evaluation set forth in this environmental statement, it is concluded that the action called for under NEPA and 10 CFR 51 is the issuance of operating licenses for Braidwood Station, Units 1 and 2.

12751 **(PB—83-258103) Draft environmental impact statement. nonmetallic mineral processing plants: background information for proposed standards.** (Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards). Apr 1983. 485p. NTIS, PC A21/MF A01.

Standards of performance for the control of emissions from nonmetallic mineral processing plants are being proposed under the authority of Section III of the Clean Air Act. These standards would apply to new, modified, or reconstructed facilities at any nonmetallic mineral processing plant including crushers, grinding mills, screens, bucket elevators, conveyor belt transfer points, bagging operations, storage bins, and enclosed truck and railcar loading stations. This document contains background information and environmental and economic impact assessments, as proposed under 40 CFR Part 60, Subpart 000.

5303 Environmental Impact Statements

REFER ALSO TO CITATION(S) 11761

12752 **(EPA—450/3-80-003b) Pressure sensitive tape and label surface coating industry - background information for promulgated standards.** Farmer, J.R. (Environmental Protection Agency, Research Triangle Park, NC (USA). Emission Standards and Engineering Div.). Sep 1983. 54p. NTIS, PC A04/MF A01. Order Number DE84900819.

Standards of performance for the control of emissions from pressure sensitive tape and label surface coatings operations are being promulgated under the authority of Section 111 of the Clean Air Act. These standards apply to pressure sensitive tape and label coating lines which emit more than 45 Mg (50 tons) of volatile organic compounds (VOC) per year and for which construction or modification began on or after the date of proposal of the regulations. This document provides a final environmental impact statement and a discussion of changes made to the standards after proposal as a result of public comments.

12753 **(NUREG—1027) Environmental impact appraisal for renewal of Source Material License No. SMB-920 (Docket No. 40-6940).** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Material Safety and Safeguards). Nov 1983. 84p. NTIS, PC A05/MF A01 - GPO $4.50. Order Number DE84900697.

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This Environmental Impact Appraisal is issued by the US Nuclear Regulatory Commission in response to an application by Cabot Corporation, Kawecki, Berylco Industries Division (KBI), for renewal of Source Material License No. SMB-920 covering facility operations near Boyertown, Pennsylvania.

55 BIOMEDICAL SCIENCES, BASIC STUDIES

5501 Behavioral Biology

REFER ALSO TO CITATION(S) 12815

12754 **Bilayer and non-bilayer configurations of mixtures of isolated chloroplast membrane lipids.** Sprague, S.G.; Staehelin, A. (Univ. of Colorado, Boulder). pp 144-159 of Biosynthesis and function of plant lipids. Thomson, W.W.; Mudd, J.B.; Gibbs, M. (eds.). Rockville, MD; American Society of Plant Physiologists (1983). (CONF-830156—).

From 6. annual botany and plant physiology symposium on biosynthesis and function of plant lipids; Riverside, CA, USA (13 Jan 1983).

We feel that the reverse-phase evaporation of lipids in Freon provides the best method for rapidly and reproducibly forming galactolipid liposomes of a known composition. This method is rapid and efficiently transfers both Monogalactosyldiglycerides (MGDG) and digalactosyldiglycerides (DGDG) to the aqueous phase. Although we still have not been able to produce bilayer structures with a native ratio of MGDG to DGDG of 2:1, we can incorporate more MGDG (30% to 40%) into DGDG bilayer liposomes without forming lipidic particles by using this method than by using either of the others described. We hope that by sonication or heating of the samples, or by the addition of other thylakoid lipids (SQDG, PG, or PC), we will be able to improve on the amount incorporated.

5502 Biochemistry

REFER ALSO TO CITATION(S) 11738, 12774, 12775, 12776, 12777, 12779, 13073

12755 **(DOE/ER/04967—T1) Gene-enzyme relationships in somatic cells and their organismal derivatives in higher plants. Progress report.** Jensen, R.A. (State Univ. of New York, Binghamton (USA). Research Foundation). 1983. Contract AC02-78ER04967. 17p. NTIS MF A01. Order Number DE84005429.

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Several enzymes involved in the biosynthesis of aromatic amino acids have been isolated from Nicotiana silvestris. Isozymes of chlorismate mutase were isolated, partially purified and subjected to enzyme kinetic analysis. In addition, studies investigating the role of 5-enolpyruvyl-shikimate-3-phosphate synthetase, 3-deoxy-D-arabino-heptulosonate 7-phosphate synthetase, shikimate dehydrogenase, prephenate aminotransferase, arogenate dehydrogenase and phenylalanine ammonia-lyase in regulation of aromatic amino acids levels in tobacco are reported.

12756 **(DOE/ER/13077—1) Soybeam ribulose bisphosphate carboxylase small subunit gene family: gene structure and regulation of gene expression. Progress report.** Meagher, R.B. (Georgia Univ., Athens (USA). Research Foundation). Jan 1984. Contract AS09-83ER13077. 2p. NTIS, PC A02/MF A01. Order Number DE84004469.

The ribulose bisphosphate carboxylase (RuBPC) small subunit gene family in soybean is being examined as a source of strong transcriptional control signals in plants. Six new RuBPC small subunit recombinants have been isolated from two new soybean DNA libraries. These clones are being characterized and compared to existing clones. Portions of a second gene, SRS2, have been sequenced and already have suggested a new approach to this gene family. It is expected that portions of the control sequences will be highly conserved between distant members of the small subunit gene family. Sequence comparison may aid us in identifying which sequences are important and should be examined further.

12757 **(DOE/EV/10327—2) Molecular events basic to cellular radiation response. Final technical report.** Kolodny, G.M. (Beth Israel Hospital, Boston, MA (USA). Div. of Nuclear Medicine). 1983. Contract AC02-80EV10327. 12p. NTIS, PC A02/MF A01. Order Number DE84005770.

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It has been suggested that low molecular weight RNA may play a role in eukaryotic gene regulation. The low molecular weight RNA was electrophoresed on 16% acrylamide gels but very small molecular weight RNA (vsRNA) was not visible after methylene blue staining. Radioautography of 3T3 and HeLa RNA labeled with ^{32}P demonstrated RNA smaller than t-RNA in size. We subsequently developed a highly sensitive silver staining procedure which revealed a very fine bands of RNA migrating faster than t-RNA. The success of platinum containing antitumor agents has stimulated interest in iridium containing agents. Irradiation of a solution of $(NH_4)_2(IrCl_6)$ in ammonia with UV light for seven hours produced a product active against Ehrlich ascites tumor with a T/C of 140% using a daily dose of 100 mg/kg for 8 days. Testing against L1210 (BDF_1 mice) indicated a low activity with a maximum increase in lifespan of 20%.

12758 (LA-UR—83-2940, pp 28-39) **Gene expression.** Hildebrand, C.E.; Crawford, B.D.; Walters, R.A.; Enger, M.D. Fal 1983. NTIS, PC A02/MF A01.

In Los Alamos Science, Fall 1983 No. 9.

We prepared probes for isolating functional pieces of the metallothionein locus. The probes enabled a variety of experiments, eventually revealing two mechanisms for metallothionein gene expression, the order of the DNA coding units at the locus, and the location of the gene site in its chromosome. Once the switch regulating metallothionein synthesis was located, it could be joined by recombinant DNA methods to other, unrelated genes, then reintroduced into cells by gene-transfer techniques. The expression of these recombinant genes could then be induced by exposing the cells to Zn^{2+} or Cd^{2+}. We would thus take advantage of the clearly defined switching properties of the metallothionein gene to manipulate the expression of other, perhaps normally constitutive, genes. Already, despite an incomplete understanding of how the regulatory switch of the metallothionein locus operates, such experiments have been performed successfully.

12759 (LA-UR—83-2940, pp 53-61) **GenBank.** Goad, W.B. Fal 1983. NTIS, PC A02/MF A01.

In Los Alamos Science, Fall 1983 No. 9.

All nucleic acid sequences containing more than fifty bases are collected for inclusion in a computer based information system. The data bank now contains about two million bases, and that number is increasing at the rate of about a million bases per year. Most of the sequences are on the order of a thousand bases long, but the longest - the entire genome of the lambda bacteriphage - contains about 50,000 bases. About 200 species are represented, although the usual laboratory species, drawn from viruses, bacteria, fruit flies, and small rodents, predominante. We do have a few unusual species - some plants and apes. However, for only a very, very few of these species is the entire genome known. In fact, even for that most studied of all bacteria, E. coli, only about 3.5 percent of its genome has been sequenced, and for Homo sapiens the fraction is less by a factor of about a thousand. The data bank entry for a sequence includes, in addition to the sequence itself, a name up to ten characters long that tries to speedily identify the sequence by at least suggesting species and function, the source of the sequence data, and a succinct description of the biological function and setting of the sequence.

12760 (LA-UR—83-2940, pp 62-63) **Quantitative comparison of DNA sequences.** Beyer, W.A.; Burks, C.; Goad, W.B. Fal 1983. NTIS, PC A02/MF A01.

In Los Alamos Science, Fall 1983 No. 9.

The combination of the GenBank database and methods for determining similarities between sequences will provide a very useful tool to molecular biologists. For example, screening the database for similarities to a newly sequenced segment of DNA can reveal, in the case of an extremely high similarity, that the new segment has been sequenced previously in either the same or a different genetic context. A lower, though still statistically significant

similarity may indicate that the two sequences share a common functional role in living cells, despite originating in different genetic locations.

12761 **Biosynthesis and function of plant lipids.** Thomson, W.W.; Mudd, J.B.; Gibbs, M. (eds.). Rockville, MD; American Society of Plant Physiologists (1983). 294p. (CONF-830156—). NTIS, PC A13/MF A01. Order Number DE84003109. Contract FG03-83ER13043.

From 6. annual botany and plant physiology symposium on biosynthesis and function of plant lipids; Riverside, CA, USA (13 Jan 1983).

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The Sixth Annual Symposium in Botany and Plant Physiology was held January 13-15, 1983, at the University of California, Riverside. This volume comprises the papers that were presented. Subjects discussed at the symposium covered a wide range in the field of plant lipids. Biosynthesis of lipids occupied an important fraction of the presentations at the symposium. Subjects included detailed studies of the enzymes of fatty acid synthesis, several discussions of the incorporation of fatty acids into glycerolipids and the further modification of the fatty acids, and the synthesis of glycerolipids and desaturation of fatty acids in both maturing oilseeds and chloroplasts. The physicochemical studies of glycerolipids and sterols in artificial membranes have led to distinct conclusions about their behaviour which must be relevant in the biological membrane. Results on the functional consequences of modifying the galactolipid composition in the chloroplast were an encouraging sign of progress in the attempts to relate membrane lipid composition to physiological function.

12762 **Molecular structures and functions of plant fatty acid synthetase enzymes.** Stumpf, P.K.; Shimakata, T. (Univ. of California, Davis). pp 1-15 of Biosynthesis and function of plant lipids. Thomson, W.W.; Mudd, J.B.; Gibbs, M. (eds.). Rockville, MD; American Society of Plant Physiologists (1983). (CONF-830156—).

From 6. annual botany and plant physiology symposium on biosynthesis and function of plant lipids; Riverside, CA, USA (13 Jan 1983).

The molecular structures of the fatty acid synthetase complexes (FAS) in eucaryotic organisms are well characterized. Clear-cut evidence about the nature of the plant FAS system was not forthcoming until 1980 to 1982. The six proteins required for FAS were separated by appropriate protein fractionation techniques. Each of these six enzymes has now been highly purified. With the availability of the seven highly purified enzymes involved in fatty acid synthesis, reconstitutive experiments were devised. When synthetase I was added to an enzyme consisting of malonyl-CoA:ACP transacylase, β-ketoacyl-ACP reductase, β-OH acyl-ACP dehydrase, and enoyl-ACP reductase in the presence of hexanoyl-ACP and ^{14}C-malonyl-CoA + ACP, the principal product (64%) was palmitic acid.

12763 **Phospholipids and metabolism.** Moore, T.S. Jr. (Louisiana State Univ., Baton Rouge); Troyer, G.D. pp 16-27 of Biosynthesis and function of plant lipids. Thomson, W.W.; Mudd, J.B.; Gibbs, M. (eds.). Rockville, MD; American Society of Plant Physiologists (1983). (CONF-830156—).

From 6. annual botany and plant physiology symposium on biosynthesis and function of plant lipids; Riverside, CA, USA (13 Jan 1983).

Several factors concerning phospholipid metabolism and utilization must be considered in order to understand the formation of cell membranes whose permeability can be regulated. It is now clear that compartmentation is a major mechanism for regulating metabolism. This paper concentrates on our research with one plant system - postgermination castor bean (Ricinus communis L. var Hale) endosperm - which has been aimed at defining the compartmentation and characteristics of enzymes involved in phospholipid synthesis.

12764 **Galactolipid biosynthesis in leaves of 16:3- and 18:3- plants.** Williams, J.P.; Khan, M.U.; Mitchell, K. (Univ. of Toronto, Canada). pp 28-39 of Biosynthesis and function of plant lipids. Thomson, W.W.; Mudd, J.B.; Gibbs, M. (eds.). Rockville, MD; American Society of Plant Physiologists (1983). (CONF-830156—).

From 6. annual botany and plant physiology symposium on biosynthesis and function of plant lipids; Riverside, CA, USA (13 Jan 1983).

Our comparative data from V. faba and B. napus show that there are fundamental differences between monogalactosyldiacylglycerol (MGDG) biosynthesis in 16:3- and 18:3- plants. In 18:3-plants MGDG appears to be derived from phosphatidyl choline (PC) as diacylglycerols containing both 18:2 and 18:3 which, after galactosylation to MGDG, are converted by further desaturation in situ to 18:3/18:3 species. The major sites of desaturation appear to be a primary site in PC and a secondary site in MGDG, although there is also the possibility of a third site of desaturation in the diacylglycerol precursors. 16:3-plants contain two pathways of almost equal importance; the 18/18C pathway in 16:3-plants appears to include some desaturation of fatty acids prior to incorporation into MGDG. The 16/18C pathway results in the biosynthesis of molecular species of MGDG containing predominantly 16:0/18:1 combinations. Desaturation of 16:0 to 16:3 in the chloroplast uses enzymes and pathways not present in 18:3-plants.

12765 **Phosphatidylcholine, an intermediate in polyunsaturated triacylglycerol synthesis.** Slack, C.R. (Dept. of Scientific and Industrial Research, Palmerston North, New Zealand). pp 40-55 of Biosynthesis and function of plant lipids. Thomson, W.W.; Mudd, J.B.; Gibbs, M. (eds.). Rockville, MD; American Society of Plant Physiologists (1983). (CONF-830156—).

From 6. annual botany and plant physiology symposium on biosynthesis and function of plant lipids; Riverside, CA, USA (13 Jan 1983).

There is now considerable support for the belief that phosphatidyl choline (PC) has a metabolic role during the formation of triglycerides polyunsaturated (TG) in seeds. The similarity in acyl composition of PC and diglycerides (DG) suggests a rapid exchange of DG moieties between pools of the two lipids. More direct evidence for such an exchange comes from the specific radioactivities of the glycerol moieties of the two lipids from cotyledons labelled with (^{3}H) glycerol. The accepted mechanism for the formation of PC in plants is the transfer of phosphorylcholine to DG catalyzed by choline phosphotransferase. The activity of this enzyme in developing safflower cotyledons is comparable with the highest activity reported for the enzyme from mammalian sources.

12766 **Modification of fatty acid composition during chloroplast ontogeny and the effects on thylakoid appression and primary photochemistry.** Leech, R.M.; Walton, C.A. (Univ. of York, England). pp 56-80 of Biosynthesis and function of plant lipids. Thomson, W.W.; Mudd, J.B.; Gibbs, M. (eds.). Rockville, MD; American Society of Plant Physiologists (1983). (CONF-830156—).

From 6. annual botany and plant physiology symposium on biosynthesis and function of plant lipids; Riverside, CA, USA (13 Jan 1983).

The simultaneous measurement of lipid, protein, and functional and ultrastructural changes during chloroplast thylakoid assembly highlights the complexities of the interactions involved in the biogenesis of photosynthetic membranes. We describe the lipid changes occuring during normal chloroplast membrane assembly and attempt to identify those specific qualitative and quantitative changes which may be particularly significant. The function of the normal chloroplast membranes is also compared with membranes whose fatty acid composition has been considerably changed by treatment with the substituted pyridazinone San 9785. The fatty acid compositional changes are accompanied by subtle but highly significant changes in thylakoid membrane development.

12767 **Lateral segregation model. A new paradigm for the dynamic role of acyl lipids in the molecular organization of photosynthetic membranes.** Murphy, D.J. (Univ. of Sheffield, England); Woodrow, I.E. pp 104-125 of Biosynthesis and function of plant lipids. Thomson, W.W.; Mudd, J.B.; Gibbs, M. (eds.). Rockville, MD; American Society of Plant Physiologists (1983). (CONF-830156—).

From 6. annual botany and plant physiology symposium on biosynthesis and function of plant lipids; Riverside, CA, USA (13 Jan 1983).

The structure of thylakoid acyl lipids and present evidence for the existence of large-scale lateral heterogeneities in their distribution along photosynthetic membranes are examined. The lateral asymmetries in chlorophyll and protein distributions shed considerable light on the molecular architecture of thylakoid membranes. We propose a new paradigm for the role of lipids in photosynthetic membrane organization-based mainly on a lateral segregation of these thylakoid components so as to optimize the light-harvesting and energy-transducing functions of the whole membrane.

12768 **Chemical induction of carotenogenesis and its relationship to chromoplast differentiation in cultured plant tissues.** Fosket, D.E.; Radin, D.N.; Guiltinan, M. (Univ. of California, Irvine). pp 195-215 of Biosynthesis and function of plant lipids. Thomson, W.W.; Mudd, J.B.; Gibbs, M. (eds.). Rockville, MD; American Society of Plant Physiologists (1983). (CONF-830156—).

From 6. annual botany and plant physiology symposium on biosynthesis and function of plant lipids; Riverside, CA, USA (13 Jan 1983).

Because of the availability of carotenogenesis mutants, we are developing an in vitro system for studying carotenogenesis in tomato. An experiental system for investigating the regulation of carotenogenesis and chromoplast differentiation at the molecular level is being developed. In this paper, we show that bioregulators can be used to study carotenogenesis and chromoplast differentiation in callus tissue and cell suspensions from many plants, including normal red-fruited and carotenoid mutant tomatoes.

12769 **Terpenoid biosynthesis in Euphorbia latex.** Nemethy, E.K.; Calvin, M. (Univ. of California, Berkeley). pp 216-228 of Biosynthesis and function of plant lipids. Thomson, W.W.; Mudd, J.B.; Gibbs, M. (eds.). Rockville, MD; American Society of Plant Physiologists (1983). (CONF-830156—). Contract AC03-76SF00098.

From 6. annual botany and plant physiology symposium on biosynthesis and function of plant lipids; Riverside, CA, USA (13 Jan 1983).

Euphorbia lathyris latex comprises an enzyme system that utilizes isoprenoid precursors for triterpenoid synthesis selectively. The observed initial rates for triterpenol and triterpene ester syntheses indicate separate sites of synthesis for these two sets of compounds. The observed selectivity in precursor utilization implies that transport of substrate through a membrane may be an important step of terpenoid synthesis in this system.

12770 **Membrane function in yeast lipid synthesis mutants.** Atkinson, K. (Univ. of California, Riverside). pp 229-249 of Biosynthesis and function of plant lipids. Thomson, W.W.; Mudd, J.B.; Gibbs, M. (eds.). Rockville, MD; American Society of Plant Physiologists (1983). (CONF-830156—).

From 6. annual botany and plant physiology symposium on biosynthesis and function of plant lipids; Riverside, CA, USA (13 Jan 1983).

The yeast lipid-synthesis mutants offer an experimentally amenable testing ground for determining the molecular requirements for specific eukaryotic cell membrane functions. Net growth of the plasma membrane requires ongoing phospholipid synthesis, specifically of the inositol-containing phospholipids. While aminophospholipid synthesis is also required for growth, yeast cells are not fastidious about which aminophospholipids are needed. Secretion, thought to share important structural features with plasma membrane assembly, does not require concomitant synthesis of the inositol-containing lipids. Some aspects of cell surface sphingolipid metabolism now appear to be accessible for genetic analysis and may serve as an entree into the degradation and recycling of yeast cell surface materials.

12771 **Binding of monoclonal antibody to protein antigen in fluid phase or bound to solid supports.** Kennel, S.J. (Oak Ridge National Lab., TN). *Journal of Immunological Methods;* **55**: 1-12(1982). Contract W-7405-ENG-26.

Rat monoclonal antibody (MoAb) to fragment D (FgD) of human fibrinogen was used to characterize the direct binding of antibody to protein in solution or bound to solid supports. Purified IgG, $F(ab')_2$ and Fab′ were prepared from ascites fluid of hybridoma 104-14B which is a fusion product of spleen cells from a rat immunized with FgD and the mouse myeloma cell line, P3-X63-Ag8. Two-dimensional electrophoresis of radioiodinated antibody preparations demonstrated the presence of hybrid immunoglobulin molecules, but only structures having rat heavy and rat light chains had active antibody combinig sites. The affinity constant for IgG as well as $F(ab')_2$ and Fab′, $6x10^9$ M^{-1}, was identical when tested using fluid phase antigen (^{125}I-labeled FgD). Affinity constants determined for direct binding of iodinated IgG using FgD immobilized on solid supports showed a slight dependence on the antigen concentration used in the measurement. These values ranged from $0.5x10^9$ M^{-1} at high antigen concentrations ($1.3x10^{-7}$ M) to $9x10^9$ M^{-1} at low antigen concentration ($1.3x10^{-10}$ M). Binding constants for $F(ab')_2$ and Fab′ gave similar results indicating that binding was homogeneous and univalent. The capacity of solid state antigen to bind antibody varied with the method used to bind FgD to the solid support. FgD bound directly to polystyrene plates was least efficient at binding labeled antibody; FgD bound to plates through intermediate carriers poly(L-lysine) was only slightly more efficient, while antigen bound to Sepharose beads by cyanogen bromide activation was the most active.

12772 **Muscle protein analysis by two-dimensional gel electrophoresis.** Giometti, C.S. (Argonne National Lab., IL). *CRC Critical Reviews in Clinical Laboratory Sciences;* **18**: No. 1, 79-109(1982). Contract W-31-109-ENG-38.

Two-dimensional electrophoresis of muscle proteins has provided valuable new information concerning the heterogeneity of some of the major contractile proteins, alterations in the protein population of developing muscle fibers during various stages of myogenesis, and protein aberrations that correlate with muscle diseases. As with all electrophoretic techniques, careful attention must be paid to the preparation of samples and the selection of reagents to be used for the protein separations. Two-dimensional electrophoresis is the obvious method of choice when analysis of protein mixtures is required. The routine clinical application of two-dimensional electrophoresis to analysis of muscle tissue remains to be demonstrated. However, methods of sample preparation for two-dimensional electrophoresis compatible with existing clinical procedures have been described, and the equipment for multiple analyses is available. As protein abnormalities related to human myopathy are detected through the use of two-dimensional electrophoresis as a research tool, useful clinical markers of specific myopathic processes will be found. The preliminary work on muscle protein analysis by two-dimensional electrophoresis described in this review has begun a new approach to the enigma of human muscle disease.

12773 **Method and cell lines for the production of monoclonal antibodies to human glycophorin A.** Bigbee, W.L.; Fong, S.S.N.; Jensen, R.H.; Vanderlaan, M. US Patent Application 6-450,694. [nd]. 18p. Contract W-7405-ENG-48.

Cloned mouse hybridoma cell lines have been established which continuously produce antibodies that differentiate between the M and N forms of human glycophorin A. These antibodies have potential application as human blood group reagents, as markers for terminally differentiated erythroid cells and as immunofluorescent labels of somatically variant human erythrocytes.

5503 Cytology

REFER ALSO TO CITATION(S) 12754, 12768, 12825

12774 **Lipid-lipid interactions and membrane fusion in plant salt glands.** Platt-Aloia, K.A.; Bliss, R.D.; Thomson, W.W. (Univ. of California, Riverside). pp 160-172 of Biosynthesis and function of plant lipids. Thomson, W.W.; Mudd, J.B.; Gibbs, M. (eds.). Rockville, MD; American Society of Plant Physiologists (1983). (CONF-830156—).

From 6. annual botany and plant physiology symposium on biosynthesis and function of plant lipids; Riverside, CA, USA (13 Jan 1983).

Tamarix is a halophyte that tolerates high levels of salinity. This capacity appears to be related to specialized salt-secreting glands in the leaves where salts are apparently compartmentalized into microvacuoles from which they are secreted by fusion with the plasmalemma. The present studies, involving both thin section and freeze-fracture electron microscopy, were focused on the ultrastructural aspects of membrane-membrane fusion invovling the microvacuoles and the plasmalemma of the secretory cells. Our results fully support the model of the formation of inverted micelles and hexagonal (H/sub II) phase lipids in the region of membrane fusion.

12775 **Free radical-mediated changes in the organization of membrane lipid bilayers: a simulation of the effects of senescence.** Thompson, J.E. (Univ. of Waterloo, Ontario); Pauls, K.P.; Chia, L.S.; Sridhara, S. pp 173-194 of Biosynthesis and function of plant lipids. Thomson, W.W.; Mudd, J.B.; Gibbs, M. (eds.). Rockville, MD; American Society of Plant Physiologists (1983). (CONF-830156—).

From 6. annual botany and plant physiology symposium on biosynthesis and function of plant lipids; Riverside, CA, USA (13 Jan 1983).

There is accumulating evidence from both plant and animal systems that deleterious free radical reactions contribute to tissue aging. Information obtained by x-ray diffraction, electron spin resonance, and fluorescence depolarization collectively suggests that there are two aspects to membrane rigidification in senescing plant tissues: (a) formation of domains of gel phase lipid and (b) decreased fluidity of residual liquid-crystalline lipid domains. One of the more deleterious consequences of any overt accumulation of reactive oxygen species is the initiation of lipid peroxidation. We have previously reported that the phase changes in membrane lipid observed during natural senescence can be simulated in vivo by treating leaves with paraquat, and in vitro by treating isolated membranes with ozone. Ozone and paraquat are both able to generate activated oxygen species. In this paper, we present data suggesting that this free radical-mediated ordering of phospholipid in membranes is attributable to neutral lipid products of lipid peroxidation.

5504 Genetics

REFER ALSO TO CITATION(S) 12758, 12759, 12760, 12773, 13073

12776 **(BNL—34094) Modes of DNA interaction in bacterial transformation.** Lacks, S.A. (Brookhaven National Lab., Upton, NY (USA)). 1983. Contract AC02-76CH00016. 14p. (CONF-831262—1). NTIS, PC A02/MF A01. Order Number DE84005315.

From International congress of genetics; New Delhi, India (12 Dec 1983).

The various modes of recombination in the transformation of S. pneumoniae are recapitulated and summarized. Two measurements of efficiency are given. Plasmid transfer and recombinant cloning involve a one-on-one interaction between separately entering complementary strands. Four modes of recombination proceed by interaction of a donor single strand with the duplex chromosome: two of these, chromosomal and plasmid (market rescue) transformation, are mediated by linear synapsis; the other two chromosomal facilitation of plasmid transfer and ectopic integration, by circular synapsis. Equilibration between plasmid and chromosome involves interaction between two duplex structures: first, integration of the plasmid into the chromosome by a reciprocal exchange in the region of homology; second, excision of the plasmid by a similar exchange event. Reversion of ectopic integration would occur by an event of the second kind.

12777 **(LA-UR—83-2940, pp 48-49) Metallothionein regulation and Menkes' disease.** Fal 1983. NTIS, PC A02/MF A01.

In Los Alamos Science, Fall 1983 No. 9.

Studies of the regulation of metallothionein synthesis have provided insight concerning the molecular basis of a human disease involve altered copper metabolism Menkes disease. We used somatic cell genetic techniques to fuse normal hamster and Menkes' human cells, creating hybrid cells with the genetic components of both species. The MT gene from the hamster cells was inactive (due to methylation) so that it could not be induced to synthesize hamster metallothionein. However, copper uptake and the synthesis of human metallothionein were found to be normal in the hybrid cells. One hypothesis is that the hybrid cells now contained a nondefective gene on the X chromosome of the hamster cell that encoded the regulator. These results suggest that the regulator is actually a repressor of MT gene activity. The results also demonstrate that inter-species regulation of metallothionein synthesis is possible, an exciting result that further points out the evolutionary conservation of the metallothionein system.

5505 Metabolism

REFER ALSO TO CITATION(S) 12762, 12763, 12764, 12765, 12766, 12830, 12834

12778 **Functional role of plant membrane lipids.** Bishop, D.G. (Macquarie Univ. North Ryde, Australia). pp 81-103 of Biosynthesis and function of plant lipids. Thomson, W.W.; Mudd, J.B.; Gibbs, M. (eds.). Rockville, MD; American Society of Plant Physiologists (1983). (CONF-830156—).

From 6. annual botany and plant physiology symposium on biosynthesis and function of plant lipids; Riverside, CA, USA (13 Jan 1983).

Plant membranes contain four major amphiphilic lipids: monogalactosyldiacylglycerol (MGDG) and digalactosyldiacylglycerol (DGDG), which are the major lipid components of chloroplast membranes, and phosphatidylcholine (PC) and phosphatidylethanolamine (PE). All membranes contain mixtures of polar lipids, and as such are mixtures of lipids capable of spontaneously assembling into bilayers (e.g. PC and DGDG) and those which assume a hexagonal phase (e.g. PE and MGDG). The possible role of nonbilayer-forming lipids in destabilizing the membrane bilayer is considered. We have studied the effect of changes in the peptide:lipid ratio in chloroplast membranes by adding the polypeptide melittin, a major component of bee venom.

12779 **Influence of lectins on plant membrane lipids.** Roberto, F.F. (Univ. of California, Riverside); Mudd, J.B.; Shannon, L.M. pp 126-143 of Biosynthesis and function of plant lipids. Thomson, W.W.; Mudd, J.B.; Gibbs, M. (eds.). Rockville, MD; American Society of Plant Physiologists (1983). (CONF-830156—).

From 6. annual botany and plant physiology symposium on biosynthesis and function of plant lipids; Riverside, CA, USA (13 Jan 1983).

No demonstrable mitogenic effect of Concanavalin A (Con A) on N. glutinosa cells was observed. Con A caused only slight changes in the proportion of label found in various lipid classes using acetate and methionine as precursors. However, a large and as yet unexplained decrease in label incorporated into lipids as a whole was attributable to Con A. Binding of Con A also seems to bring about a small delay in efflux of ^{45}Ca from treated cells, but this effect decays within 3 h.

12780 **Use of semiconductor topographic detection of beta-labelled materials in plant physiology.** Tykva, R. (Ceskoslovenska Akademie Ved, Prague. Ustav Organicke Chemie a Biochemie); Krekule, J. (Ceskoslovenska Akademie Ved, Prague. Ustav Experimentalni Botaniky). pp 160-164 of Application of nuclear methods and ionizing radiation in plant genetics, breeding and physiology. Proceedings of national seminar. Brno, Czechoslovakia; Vysoka Skola Zemedelska (1980). (In Czech)(CONF-8010329—).

From Conference on application of nuclear methods and ionizing radiation in plant genetics, breeding and physiology; Brno, Czechoslovakia (7 Oct 1980).

The distribution of compounds labelled with beta decay radionuclides (e.g., ^{32}P or ^{14}C) in botanical objects was investigated using a topographic method based on radiation measurement with a silicon semiconductor detector. The instrument allowed the estimation of radioactivity in individual organs and/or tissues. The method is nondestructive and allows quantitative evaluations of more than one source of radiation. A simple block diagram of the equipment is presented and its applicability is demonstrated on examples of studies of the role of growth substances in the photoperiodic flower induction and in the differentiation of flower organs.

5506 Medicine

REFER ALSO TO CITATION(S) 12553, 12808, 12809, 12823, 12837, 12962

12781 **(CEA-CONF—6819) Usefulness of brain SPECT.** Raynaud, C.; Rancurel, G.; Kieffer, E.; Ricard, S.; Askienazy, S.; Moretti, J.L.; Bourdoiseau, M.; Rapin, J.; Soussaline, F. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Jan 1983. 5p. (CONF-830155—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750457.

From 21. annual meeting of the European Society of Nuclear Medicine; Ulm, F.R. Germany (27 Jan 1983).

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Brain SPECT was not effectively exploited until I-123 isopropyl amphetamine (IAMP), an indicator able to penetrate the blood brain barrier, became available. Although the experience of research teams working with IAMP is quite restricted due to the high cost of the indicator, some applications now appear to be worth the cost and in some cases provide data which cannot be obtained with routine techniques, especially in cerebrovascular patients, in epilepsy and some cases of tumor. Brain SPECT appears as an atraumatic test which is useful to establish a functional evaluation of the cerebral parenchyma, and which is a complement to arteriography, X-ray scan and regional cerebral blood flow measurement.

12782 **(CEA-CONF—6841) Local cerebral metabolic rate of ^{11}C-L-Methionine in early stages of dementia, schizophrenia, Parkinson's disease.** Bustany, P.; Henry, J.F.; de Rotrou, J.; Signoret, J.L.; Ziegler, M.; Zarifian, E.; Soussaline, F.; Comar, D. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Jun 1983. 3p. (CONF-8306151—5). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750453.

From 11. international symposium on cerebral blood flow and metabolism; Paris, France (20 Jun 1983).

A dynamic three-compartment model of methionine metabolism in brain was applied in human patients using ^{11}C-L-methionine and positron emission tomography (P.E.T). Psychometric evaluations of demented patients were correlated with a significant diminution of protein synthesis in the frontal area. This diminution was lower in ebephrenic patients (-17%) but was consistent with the results obtained with ^{18}F glucose. No significant abnormality was detected in patients with Parkinson disease.

12783 **(CEA-CONF—6842) Local CBF, oxygen extraction fraction (OEF) and $CMRO_2$: prognostic value in recent supratentorial infarction in humans.** Baron, J.C.; Rougemont, D.; Bousser, M.G.; Lebrun-Grandie, P.; Iba-Zizen, M.T.; Chiras, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Jun 1983. 4p. (CONF-8306151—4). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750452.

From 11. international symposium on cerebral blood flow and metabolism; Paris, France (20 Jun 1983).

Cerebral blood flow (CBF) and oxygen consumption ($CMRO_2$) have been measured locally using positron emission tomography (PET) in 25 patients (34 studies) with recent cerebral infarction. The data analysis yielded threshold values for CBF and $CMRO_2$ that reliably separated the brain areas spontaneously evolving to necrosis from those maintaining integrity (as determined by C.T. Scanning) but still showing significant changes in CBF and/or $CMRO_2$. These results suggest the potential use of PET for estimation of tissue prognosis in recent cerebral infarction.

12784 **(CEA-CONF—6843) Local cerebral metabolic rate of glucose (lCMRGlc) in treated and untreated patients with Parkinson's disease.** Rougemont, D.; Baron, J.C.; Collard, P.; Bustany, P.; Comar, D.; Agid, Y. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Jun 1983. 3p. (CONF-8306151—3). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750447.

From 11. international symposium on cerebral blood flow and metabolism; Paris, France (20 Jun 1983).

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Local cerebral metabolic rate of glucose (lCMRGlc) was measured twice, using positron emission tomography and ^{18}F-Fluoro-2-deoxy-D-glucose (^{18}FDG), in 4 patients with Parkinson disease, first unmedicated and then treated with L-DOPA. Despite a dramatic clinical improvement, no significant changes in lCMRGlc could be detected. Moreover, no reproducible differences of lCMRGlc were found between patients with Parkinson disease and with normal brain.

12785 **(CEA-CONF—6844) Positron tomography investigation in humans of the local coupling among CBF, oxygen consumption and glucose utilization.** Baron, J.C.; Rougemont, D.; Soussaline, F.; Crouzel, C.; Bousser, M.G.; Comar, D. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Jun 1983. 3p. (CONF-8306151—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750436.

From 11. international symposium on cerebral blood flow and metabolism; Paris, France (20 Jun 1983).

Positron tomography investigation of the local coupling among cerebral blood flow (CBF), oxygen consumption ($CMRO_2$) and glucose utilization (CMRGlc) was performed in 5 controls and 6 ischemic stroke patients, using oxygen 15 inhalation technique immediately followed by I.V. injection of ^{18}F-Fluoro-Desoxyglucose (^{18}FDG). The normal couple among all 3 variables was demonstrated; but on the other hand significant disruption of either or both the CBF-CMRGlc and the $CMRO_2$-CMRGlc couples was found in all 6 stroke patients. Comments on these new findings were made.

12786 **(CEA-CONF—6845) Effects of normal aging on regional CBF and $CMRO_2$ in humans.** Pantano, P.; Baron, J.C.; Lebrun-Grandie, P.; Duquesnoy, N.; Bousser, M.G.; Comar, D. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Jul 1983. 19p. (CONF-8306153—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750449.

From 2. symposium on effects of aging on regulation of cerebral blood flow and metabolism; San-Remo, Italy (30 Jun 1983).

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The oxygen-15 continuous inhalation technique and positron emission tomography were used in order to investigate age-related changes of cerebral blood flow (CBF) and oxygen consumption ($CMRO_2$). 27 patients aged 19 to 76 years without evidence of dementia, brain disease or vascular risk factors, were studied. Regional CBF and $CMRO_2$ were calculated in seven different brain struc-

tures. In gray matter CBF and $CMRO_2$ decreased with aging (respectively 18% and 17%, $p<0.05$) but white matter values were not affected by aging. The decline in grey matter regional CBF and $CMRO_2$ was found to be diffuse but to affect principally the frontal and temporo-sylvian cortex. Neuronal loss and/or a diminished metabolic activity of residual neurons are the most likely hypotheses to explain these findings.

12787 (CEA-CONF—6851) [^{11}C]-DMO for evaluation of regional tissue pH in patients with hemispheric infarction using positron emission tomography. Castaing, M.; Syrota, A.; Rougemont, D.; Berridge, M.; Chretien, L.; Baron, J.C.; Bousser, M.G. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Jun 1983. 3p. (CONF-8306151—2). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750438.

From 11. international symposium on cerebral blood flow and metabolism; Paris, France (20 Jun 1983).

Changes in brain intracellular pH resulting from cerebral infarction were evaluated using the ^{11}C-DMO (dimethyloxazolidinedione) method, in 9 patients. A $^{15}O_2$-$C^{15}O_2$ study was performed the day following the DMO examination in order to obtain the values of cerebral blood flow, oxygen extraction and oxygen metabolic rate in the same regions-of-interest. The results emphasized the relationship between tissue alkalosis and luxury perfusion during recent infarction.

12788 (CEA-CONF—6853) Quantitative SPECT reconstruction for brain distribution with a non-uniform attenuation using a regularizing method. Soussaline, F.; Bidaut, L.; Raynaud, C.; Le Coq, G. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Jun 1983. 7p. (CONF-830627—2). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750448.

From Conference on tracer kinetics and physiologic modeling - theory to practice; St. Louis, MO, USA (6 Jun 1983).

An analytical solution to the SPECT reconstruction problem, where the actual attenuation effect can be included, was developped using a regularizing iterative method (RIM). The potential of this approach in quantitative brain studies when using a tracer for cerebrovascular disorders is now under evaluation. Mathematical simulations for a distributed activity in the brain surrounded by the skull and physical phantom studies were performed, using a rotating camera based SPECT system, allowing the calibration of the system and the evaluation of the adapted method to be used. On the simulation studies, the contrast obtained along a profile, was less than 5%, the standard deviation 8% and the quantitative accuracy 13%, for a uniform emission distribution of mean = 100 per pixel and a double attenuation coefficient of $\mu = 0.115$ cm^{-1} and 0.5 cm^{-1}. Clinical data obtained after injection of 123 I (AMPI) were reconstructed using the RIM without and with cerebrovascular diseases or lesion defects. Contour finding techniques were used for the delineation of the brain and the skull, and measured attenuation coefficients were assumed within these two regions. Using volumes of interest, selected on homogeneous regions on an hemisphere and reported symetrically, the statistical uncertainty for 300 K events in the tomogram was found to be 12%, the index of symetry was of 4% for normal distribution. These results suggest that quantitative SPECT reconstruction for brain distribution is feasible, and that combined with an adapted tracer and an adequate model physiopathological parameters could be extracted.

12789 (CEA-CONF—6909) Regularizing method for ill-posed problems: application to quantitative reconstruction in single photon emission computed tomography. Soussaline, F.; Le Coq, G.; Bidaut, L.; Hermouche, D. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Sep 1983. 4p. (CONF-830801—2). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750454.

From 8. information processing in medical imaging conference; Brussels, Belgium (29 Aug 1983).

The problem of the general 3D reconstruction of a volumic distributed function may be considered as the inversion of the operator modelling the actual detection procedure of the multiple projections. In the context of single photon emission computed tomography (SPECT), the operators, are Fredholm integrals of the first kind. This mean that the problem is the so-called Hadamard "ill-posed" problem, and that weak perturbations in the initial data could lead to large variations in the sought solution. A regularizing method of the SPECT reconstruction problem is proposed. The regularization shown on the simulated and clinical studies seems to be valuable for contrast enhancement, quantitative precision and noise minimization.

12790 (DOE/ID/12151—2) ACNP Public Education Program on nuclear medicine and related low-level waste issues. Final technical report, 7 July 1980-30 June 1983. (American Coll. of Nuclear Physicians, Washington, DC). [nd]. Contract FG07-80ID12151. 273p. NTIS MF A01. Order Number DE84005416.

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The goal of the ACNP Public Education Program was to educate and inform the greatest number of people in the areas of radiation and health and, in turn, to gain the public's understanding of Nuclear Medicine. The related low-level waste issues also were incorporated into the program. To carry out the program's objectives and design to educate the public, the ACNP established a Speaker Bureau which consists of those members of the ACNP and the Society of Nuclear Medicine (SNM) who go through the training seminars, conducted by ACNP, and are available to speak publicly about Nuclear Medicine and related low-level waste issues. In addition, the ACNP developed the necessary audiovisual and printed materials to be used in their own right or as supplemental tools. Promotion of the Speakers Bureau and the audiovisual materials to the media and other various public forums was undertaken.

12791 (DOE/SF/00012—T20) Emergence of positron emission tomography as a clinical tool for studying local myocardial function. Schelbert, H.R. (California Univ., Los Angeles (USA)). 1983. Contract AC03-76SF00012. 41p. NTIS, PC A03/MF A01. Order Number DE84005634.

The increasing number of studies employing Positron-CT for the study of regional myocardial blood flow and metabolism in humans as well as the ever increasing number of institutions implementing Positron-CT are likely to move this new field into the realm of routine diagnostic use. Efforts for expanding and increasing the number of specific metabolic tests to evaluate the human heart in disease are described. Techniques for external quantification of regional blood flow in ml/min/gm, of oxygen consumption, free fatty acid utilization in terms of mmoles/gm/min, assessment of tricarbonic acid cycle activity and of protein synthesis as well as of cardiac receptors appear possible in the near future and will add a new dimension to our understanding of the human heart's normal function and human cardiac disease.

12792 (INIS-mf—8202) Quantitative skeletal scintiscanning. Diagnostic value of the region of interest technique. Haushofer, R. (Muenchen Univ. (Germany, F.R.). Fakultaet fuer Medizin). 23 Mar 1982. 52p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83704231.

330 patients were examined by skeletal scintiscanning with sup(99m)Tc pyrophosphate and sup(99m)methylene diphosphonate in the years between 1977 and 1979. Course control examinations were carried out in 12 patients. The collective of patients presented with primary skeletal tumours, metastases, inflammatory and degenerative skeletal diseases. Bone scintiscanning combined with the "region of interest" technique was found to be an objective and reproducible technique for quantitative measurement of skeletal radioactivity concentrations. The validity of nuclear skeletal examinations can thus be enhanced as far as diagnosis, course control, and differential diagnosis are concerned. Quantitative skeletal scintiscanning by means of the "region of interest" technique has opened up a new era in skeletal diagnosis by nuclear methods.

12793 **(INIS-mf—8214) Preventricular lucency in computerized tomography of various forms of hydrocephalus.** Sprung, C. (Freie Univ. Berlin (Germany, F.R.). Medizinische Fakultaet). 23 Jun 1981. 101p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE83704229.

602 patients with 8 different types of hydrocephalus have been examined for PVL on the basis of 18,413 CT pictures. The localisation of PVL, in the periventricular white matter of the anterior horns, and its configuration are independent of the type of hydrocephalus and of the intraventricular pressure. In contrast, the intensity and incidence of PVL are a function of the type of hydrocephalus. Factors influencing these two parameters are in order of importance: The intraventricular pressure, the acuteness of the process leading to stenosis (i.e. the rate of development of hydrocephalus), the extent of ventricular enlargement, the compliance of ventricular wall and osseous part of the skull, the volume of the ventricles, and the localisation of the obstructing and displacing process. Independent of the type of hydrocephalus, disappearance of PVL is always well correlated with improved clinical symptoms and, in most cases, also with a reduction of the ventricular volume. As far as the pathomechanism is concerned, the studies suggest passive inflow of liquor through the damaged ependyma rather than an active absorption process.

12794 **(INIS-mf—8215) Pylorus and surrounding tissues. A combined radiological manometric examination of gastroduodenal junction.** Persigehl, M. (Technische Hochschule Aachen (Germany, F.R.). Medizinische Fakultaet). 24 Nov 1980. 131p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE83704230.

The pylorus function is not that of a digestive sphincter. A zone of manometric high pressure has not been found in any part of the gastroduodenal junction. The process of evacuation of the stomach itself could not be observed accurately enough with the method employed, so that a final statement on pylorus function during evacuation of the stomach cannot be presented. Isolated pylorus contractions without previous contractions of the pyloric canal or the duodenal bulb were observed with neither of the two methods. There are two types of contraction in the pyloric canal: First, a process of annular motility similar to peristalsis; secondly, type B contractions, typically with shortening of the lesser curvature in the pyloric canal, pseudodiverticular protrusion of the greater curvature and tubular constrictions of the pyloric canal accompanied by constriction of the pyloric muscle. When this process takes place in its complete form, pressure changes can be observed in the pyloric canal and always in the pylorus. Independent of the antral contraction processes, there are two forms of bulb contractions. The first type, with complete contractions of the pyloric bulb, influences the pylorus while the second type, with weak annular contractions propagating in both directions from the top of the pyloric bulb, does not. Administration of gastrin or pentagastrin results in more rhythmic contractions of the gastroduodenal junction. The contractions themselves are more pronounced and last longer than without drug administration.

12795 **(INIS-mf—8217) Inhalation scintiscanning of persons with healthy lungs and lung diseases using sup(99m)Tc-sulfur colloid with special regard to the mucociliary clearance.** Kluge, F.S. (Technische Univ. Muenchen (Germany, F.R.). Fakultaet fuer Medizin). 3 Jun 1981. 56p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83704232.

It is reported about inhalation scintiscanning with radioaerosols under the application of a gamma camera and a magnetic core- and tape memory, providing an interactive display. 89 patients suffering form various pulmonary diseases and 10 test persons with healthy lungs were investigated. The scintigraphic photos were not only evaluated visually, but also according to quantitative parameters, i.e. left/right distribution, degree of central deposition and mucociliary clearance. The latter resulted to be the most informative quantitative diagnostic method. In the 10 test persons with healthy lungs the scintigraphic images always showed a homogeneous distribution of radioactivity and a mucociliary half-time of 9.7 or 11.9 hours respectively was found. A central bronchial carcinoma provoked on the affected side of the lungs a reduced deposition of radioactivity, an increased central deposition and an accelerated mucociliary clearance. In patients suffering from peripheral bronchial carcinoma, pneumonia, pleural processes, pulmonary infarction, pulmonary circular focus or pneumothorax, only inconstant areas of reduced radioactivity deposition could be detected. However, these areas differed by shape, intensity and location from the central bronchial carcinoma. In 3 patients with pulmonary embolism, no pathologic changes could be detected only then, when no infarction occurred. In this case, also the quantitative parameters were normal. With chronical obstructive pulmonary diseases, diseases of the pulmonary framework and in cases of bronchial asthma a clearly pathologic image of the distribution of radioactivity resulted in all cases; in these a differentiation could only be achieved by additionally considering the quantitative parameters.

12796 (INIS-SU—179, pp 26-29) **Radioisotope tests in evaluating the efficiency of hydrocephaly treatment in children.** Gordeev, S.M. 1980. (In Russian). NTIS (US Sales Only), PC A06/MF A01.

In Radioisotope diagnosis in pediatrics and infantine surgery. Collection of scientific proceedings.

48 children with hydrocephaly were examined to control efficiency of surgical and conservative treatments. Used were the following radioisotope methods: determination of linear velocity of cerebral blood flow by the radiocirculography method, radioisotope ventriculography as well as the investigation of liquordynamics by means of distant radiometry. Side effects and complications were not observed during the examination. It is established that diagnostic tests using short-living radionuclides sup(99m)Tc, sup(113m)In during insignificant radiation burden possess high information capacity when investigating cerebral hemodynamics and morphofunctional state of liquor circulation tracts when it is necessary to control efficiency of treatment of hydrocephaly in children.

12797 (INIS-SU—179, pp 79-81) **Comparative evaluation of radioisotope tests in definition of urodynamic pathology in children.** Nachev, A.V. 1980. (In Russian). NTIS (US Sales Only), PC A06/MF A01.

In Radioisotope diagnosis in pediatrics and infantine surgery. Collection of scientific proceedings.

To refine values of radioisotope renography at different stages of evolution of disturbances of upper urinary tract urodynamics, 174 sick children with different urologic pathologies have been examined. Analysis of the results obtained shows that radioisotope renography permits to diagnose deviations in urodynamics at early stages. When comparing the data of radioisotope renography and other diagnostic methods such as excretory urography, biochemical samples etc., considerable value of this method as functional one is noted. The method of radioisotope renography has the highest information capacity together with other diagnostic methods.

12798 (INIS-SU—179, pp 56-61) **Radioisotope diagnostics of lung pathology in children by clinical data.** Volchkov, E.M. 1980. (In Russian). NTIS (US Sales Only), PC A06/MF A01.

In Radioisotope diagnosis in pediatrics and infantine surgery. Collection of scientific proceedings.

Analysis of clinical data (118 patients) shows convincingly that radioisotope investigations play an important role in recognition of lung pathology in children. Diagnostic value of the method increases especially in those cases when clinical-roentgenological diagnostics of this pathology turns out to be difficult. Expressiveness of scannographic signs permits to differentiate different forms of lung pathology and alongside with this to observe dynamics of pathological processes in lungs which makes it possible to perform selective therapeutic tactics in either concrete situation.

12799 **(ORNL/TM—8966) Nuclear medicine progress report, quarter ending September 30, 1983.** Knapp, F.F. Jr.; Ambrose, K.R.; Butler, T.A.; Goodman, M.M.; Srivastava, P.C. (Oak Ridge National Lab., TN (USA)). Jan 1984. Contract W-7405-ENG-26. 27p. NTIS, PC A03/MF A01. Order Number DE84006207.

The results of a systematic evaluation of adsorbents for potential use in the ^{191}Os//sup 191m/Ir medical radionuclide gener-

ator are described. The adsorbents included 39 inorganic materials broadly classified as oxides, antimonates, ferro-ferricyanides, phosphates, sulfides, and miscellaneous materials, and the organic anion-exchanger AGMP-1. The uptake of ^{191}Os in oxidation states (VI), (IV) and (III) was measured and the adsorbents having a high ^{191}Os uptake were evaluated for /sup 191m/Ir elution yield using three physiologically compatible eluents. The synthesis and evaluation of a variety of radiolabeled fatty acids as potential myocardial imaging agents has continued. Because of interest in the use of radiobrominated fatty acids for positron emission tomographic evaluation (PET) of myocardial disease, several bromine-82 labeled agents were prepared and studied. These include both cis (Z) and trans (E) 18-[^{82}Br]bromo-5-tellura-17-octadecenoic acid and 17-[^{82}Br]bromo-9-telluraphetadecanoic acid. A variety of telluraheptadecanoic acid (THDA) analogs and other fatty acids have been evaluated using the rat myoblast assay system. In the most recent studies 11-THDA, 18-bromo-9-THDA and 15-(iodophenyl)-3-R,S-methylpentadecanoic acid (BMIPP), were evaluated for myoblast uptake and retention.

12800 **(PB—84-937600) Cancer detection and management: nuclear medicine. Cancergram ct02.** (National Cancer Inst., Bethesda, MD (USA). International Cancer Research Data Bank). 1984. 12 issuesp. Paper copy available on subscription, North American Continent price $30.00/year; all others write for quote. Also available in single copies.

The Cancergram covers all aspects of the clinical use of radionuclides or nuclear medicine techniques in the care of cancer patients. It also includes any preclinical studies of various radionuclides or techniques considered to have direct clinical diagnostic relevance. Other basic biologic, pharmacologic, or metabolic studies where radionuclides are used as tracers will generally be excluded. Radiotherapy is covered by Cancergram CT15, and Diagnostic Radiology by Cancergram CT14.

12801 **(PB—84-939000) Clinical treatment of cancer: radiation therapy. Cancergram ct15.** (National Cancer Inst., Bethesda, MD (USA). International Cancer Research Data Bank). 1984. 12 issuesp. Paper copy available on subscription, North American Continent price $30.00/year; all others write for quote. Also available in single copies.

This Cancergram covers all forms of radiotherapy being used in the treatment of cancer, including standard x-ray, cobalt 60 and radium irradiation as well as high linear energy transfer (LET), megavoltage, electron beam treatment, and radioactive interstitial implants. Coverage of this topic includes adverse effects of radiotherapy, radiocurability, radiodosimetry, radiosensitization, and study with specialized instrumentation such as the betatron and linear accelerator. Radiobiology, animal experiments, tissue culture experiments, carcinogenesis, and other preclinical studies will not be included except for those considered to have direct clinical relevance.

12802 **(PB—84-939100) Cancer detection and management: diagnostic radiology. Cancergram ct14.** (National Cancer Inst., Bethesda, MD (USA). International Cancer Research Data Bank). 1984. 12 issuesp. Paper copy available on subscription, North American Continent price $30.00/year; all others write for quote. Also available in single copies.

The Cancergram covers the field of diagnostic radiology from amniography to xerography in all of its clinical applications. It also includes such closely related techniques as fluoroscopy, ultrasonography, and thermography. Areas of interest are the clinical applications of these techniques, instrumetation, comparative studies, and any preclinical studies that have direct clinical relevance. Radiation therapy, or the use of radioactive isotopes and other nuclear medicine techniques, are not in scope, as they are covered by Cancergrams CT15 and CT02, respectively.

12803 **(Zfl-Mitt—65) Nitrogen-15 reference book: medicine and biosciences.** Faust, H. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Apr 1983. 53p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE83703872.

A comprehensive bibliography on the application of the stable nitrogen isotope ^{15}N in medicine, animal nutrition and physiology, biosciences, and related disciplines is presented. The literature pertaining to this paper covers the period from 1977 to 1981. The references are completed by an index of all authors and a subject index with special emphasis to the used organisms, labelled compounds, and tracer techniques, respectively.

12804 **Clinical evaluation of Tc-99m N,N'-bis(mercaptoacetyl)-2,3-diaminopropanoate as a replacement for I-131 hippurate: concise communication.** Kingensmith, W.C. III; Fritzberg, A.R.; Spitzer, V.M.; Johnson, D.L.; Kuni, C.C.; Williamson, M.R.; Washer, G.; Weil, R. III. (Univ. of Colorado Health Sciences Center, Denver, CO). *Journal of Nuclear Medicine;* 25: No. 1, 42-48(Jan 1984).

A clinical comparison of Tc-99m N,N'-bis(mercaptoacetyl)-2,3-diaminopropanoate (Component A) (Tc-99m CO_2-DADS-A) and I-131 hippurate was conducted in a series of five normal volunteers and 18 patients. Each subject was studied in one session with Tc-99m CO_2-DADS-A and I-131-hippurate; digital and analog images were recorded for 30 min and after voiding. In the normal volunteers, digital images with Tc-99m CO_2-DADS-A gave a kidney-to-background ratio at 3 min that was greater relative to I-131 hippurate, a leading-edge parenchymal transit time that was similar to I-131 hippurate, and a percent injected dose in the urine at 30 min that was slightly less than I-131 hippurate ($p<0.05$). In patients (serum creatinine 1.0 to 14.3 mg/dl), deceasing renal function impaired excretion of Tc-99m CO_2-DADS-A more than that of I-131 hippurate ($p < 0.01$). In analog images, Tc-99mCO_2-DADS-A always gave superior spatial resolution. No evidence of hepatobiliary excretion was detected with either radiopharmaceutical. The authors conclude that Tc-99m CO_2-DADS-A and similar compounds should be pursued as possible replacements for I-131 hippurate

12805 **Radioimmunoassay of estrone, estradiol, estriol, progesterone, cortisol and prolactin in maternal venous blood and the cord blood of the newborn child.** Fritschi, J. Tuebingen, Germany, F.R.; Tuebingen University (1980). 53p. (In German). Library of Tuebingen Univ. (Germany, F.R.).

The estrone analyses showed that E_1 levels are not sex-dependent. The Prog/E_2 ratio changed when the children were in states of exceptional stress; analogous findings were obtained in the acidose group. Due to the wide range of variations of E_3, it was found to be impossible to determine the stage of pregnancy from the E_3 level. Progesterone levels were significantly higher in the blood of the umbilical vein than in the umbilical artery. Prolactine levels of both the umbilical vein and the umbilical artery are significantly higher than in the mother's venous blood. Cortisol levels differed with the type of delivery, especially when comparing Caesareon with normal delivery. Also, differences were found between deliveries with more or less stress. There is no significant difference between E_3/prog ratios measured during induced labour, immature delivery, application of analgetics; instead, cortisol levels are best correlated with the clinical criteria of birth stress, especially during the expulsion period in which stress factors are highest. Further, there is a correlation between the cortisol levels of the umbilical vein and the mother's venous-blood.

5507 Microbiology

REFER ALSO TO CITATION(S) 12770, 12811

12806 **(NP—4770156) Continuous analytical procedure for studying the dynamic behaviour of a methanol-utilizing microbial culture.** Imming, G. (Technische Univ. Braunschweig (Germany, F.R.). Naturwissenschaftliche Fakultaet). 11 Nov 1981. 89p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84770156.

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In cultures of the methanol-utilizing bacterium Methylomonas M-15 sodium polyphosphate has been found to be suitable as complexing agent for divalent ions and as the sole source of phosphate for the organism. A 1 litre bioreactor with an in situ oxygen supply fromt he electrolysis of water can be used to culture M. M-15 cells. The specific requirments of certain nutrients can be ascertained throughout by continuous analysis of the culture medium

during growth. The RNA content in static M. M-15 cultures drops during growth dormancy; this effect is particularly noticeable when cultures are stores under exclusion of air. During the growth phase Methylomonas M-15 produces formaldehyde which reduces the rate of growth. The growth kinetics of this microorganism are largely influenced by this self-inhibiting mechanism.

5508 Morphology

REFER ALSO TO CITATION(S) 12772

12807 **An empirical comparison of estimation procedures for the von Bertalanffy growth equation.** Vaughan, D.S.; Kanciruk, P. (Oak Ridge National Lab., TN). *Journal du Conseil, Conseil International pour l'Exploration de la Mer;* 40: 211-219(1982). Contract W-7405-ENG-26.

One non-linear and two linear methods of fitting the von Bertalanffy growth equation to length-age data were compared using Monte Carlo simulations of fish populations while varying the standard error of the length, total sample size, sampling time interval, von Bertalanffy growth parameter, and annual adult survival. The iterative, non-linear method usually produced the most accurate and precise parameter estimates. The non-linear method also provided asymptotic confidence intervals about point estimates, placed fewest constraints on data collection, and was the easiest to use. It is suggested that traditional linear solutions to the von Bertalanffy growth equation be abandoned.

5509 Pathology

REFER ALSO TO CITATION(S) 12772, 12773

12808 **(DOE/SF/00012—T21) Metabolic tissue characterization of reperfused canine myocardium by C-11 palmitic acid.** Schwaiger, M.; Schelbert, H.R.; Keen, R.; Vinten-Johansen, J.; Hansen, H.; Selin, C.; Barrio, J.; Huang, S.C. (California Univ., Los Angeles (USA)). 1983. Contract AC03-76SF00012. 34p. NTIS, PC A03/MF A01. Order Number DE84005633.

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While oxidation of fatty acid declines or even ceases during ischemia, the recovery of myocardial fatty acid metabolism after transient ischemia has remained largely unexplored. Using C-11 palmitic acid as a tracer of myocardial fatty acid metabolism, we evaluated in open chest dogs the myocardial retention and subsequent tissue clearance of intracoronary injected C-11 palmitic acid at control and up to 3 hours after a 20 min occlusion of the LAD. In animals with permanent occlusion, the relative size and halftime of the early clearance curve component, representing oxidation of C-11 palmitic acid, differed markedly from control and did not change with ongoing ischemia. In animals with a 20 min coronary occlusion, the relative size of the early C-11 clearance phase was still significantly depressed at 20 and 90 min of reperfusion but had returned to control at 180 min. The tissue C-11 clearance halftimes remained significantly prolonged throughout the entire reperfusion period. Regional function in the reperfused segments monitored with ultrasonic crystals recovered only slowly and was still less than control after 3 hrs of reperfusion. These data indicate that myocardial fatty acid metabolism after transient ishemia recovers slowly. C-11 palmitic acid in conjunction with Positron-CT may thus be useful for studying regional fatty acid metabolism noninvasively following an ischemic injury and may be helpful in identifying reversible tissue injury.

12809 **(DOE/SF/00012—T22) Artifactual reductions of segmental indicator tissue concentrations on tomographic images of the heart caused by regional wall motion abnormalities.** Parodi, O.; Schelbert, H.R.; Schwaiger, M.; Hansen, H.; Selin, C.; Hoffman, E.J. (California Univ., Los Angeles (USA)). 1984. Contract AC03-76SF00012. 29p. NTIS, PC A03/MF A01. Order Number DE84005635.

Possible effects of regional wall motion abnormalities on apparent regional myocardial tracer concentrations on emission tomographic images were evaluated in 6 open chest dogs. Each dog was studied twice: In Run 1, N-13 ammonia and microspheres were injected during a 6 min coronary occlusion, and serial images acquired with positron-emission tomography during occlusion and reperfusion. In Run 2, one hour later, N-13 ammonia and microspheres were reinjected at control and serial images recorded at control, during a repeat 6 min coronary occlusion, and after reperfusion. Segmental function was monitored with ultrasonic crystals, and N-13 tissue concentrations determined in vivo from the tomographic images and postmortem by well counting. In Run 1, fractional shortening in ischemic segments fell by 89 +- 16% SD from control. The ischemic versus control segment ratio for N-13 activity concentrations averaged 0.29 +- 0.08 and for microspheres 0.20 +- 0.15. In Run 2, the ischemic versus control segment ratio was at control 0.77 +- 0.12 for N-13 tissue activity and 0.85 +- 0.07 for microspheres. Fractional shortening fell during occlusion by 131 +- 29% from control, returned to control early and then fell again by 11 +- 16% late during reperfusion. These changes were paralleled by changes in apparent regional N-13 tissue concentrations of the pre-labeled myocardium.

5510 Physiological Systems

REFER ALSO TO CITATION(S) 12777, 12794

5520 Public Health

REFER ALSO TO CITATION(S) 12729

5530 Agriculture And Food Technology

REFER ALSO TO CITATION(S) 12755

12810 **(CEA-CONF—6852) Results of direct measures of the utilization coefficient of fertilizers by isotopic labelling with ^{32}P, ^{15}N and ^{40}K.** Fardeau, J.C.; Guiraud, G.; Hetier, J.M.; Jappe, J.; Marol, C.; Darme, S.; Berlier, Y. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France)). Jun 1983. 13p. (CONF-8306155—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750451.

From Meeting of the International Chemical Fertilizer Center; Uppsala, Sweden (13 Jun 1983).

Several types of information are needed for an understanding of the rational utilization of fertilizers: 1. Percentage of the fertilizer transferred to the first harvest following the application; 2. Percentage of the element in the harwest which is derived from the fertilizer; 3. Fate of the part of the fertilizer which is not taken up by the first crop and remains in the plough-layer of soil. These data can, to a certain extent, be obtained only by use of labelled compounds. After a review of the technical requirements associated to isotopic measurements such as counting by liquid scintillation or Cerenkov effect for ^{32}P, mass or optical spectrometry for nitrogen 15, low back-ground counting for ^{40}K, the results obtained in field experiments are presented. The utilization coefficient of mineral nitrogen varies from 4% to 80%, while that of phosphorus, in soluble forms, varies from 0,5% to 10%. The most interesting results concerns the use of ^{40}K, the natural radioisotope of potassium whose half-live is $1{,}3.10^9$ years. During year 1982, in the calcareous soil of Cadarache, with three different crops grown in lysimeters, the utilization coefficient of potassium fertilizer added as KCl was 10%. All these results are interpreted as in relation to the soil fixing capacity for the different nutrients.

12811 **(CEA-CONF—6935) Determination of a "microbial nitrogen" compartment in soil.** Nicolardot, B.; Chaussod, R.; Guiraud, R. (Institut National de Recherches Agronomiques (INRA), 75 - Paris (France); CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France)). Jul 1983. 9p. (CONF-8307108—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750456.

From Meeting on biological processes and soil fertility; Reading, UK (4 Jul 1983).

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In laboratory studies, the authors tried to get to the microbial nitrogen compartment by the chloroform-fumigation technique using labelled (^{14}C and ^{15}N) microorganisms with various C/N ratios (from 5,1 to 12,7). The decomposition of this microbial organic matter was recorded in 3 different soils during a 28 days incubation at 28°C. The results pointed out that the mineralization rate of the ^{14}C microbial carbon was approximatively the same whatever the C/N ratio of the added organic matter, but showed significant variations with the soil type. Conversely, the mineralisation rate for ^{15}N varied much more with the C/N ratio of the decaying microbial organic ^{15}N than with the soil type: roughly 20 to 50% of the added organic ^{15}N was mineralized in 7 days at 28°C in the fumigated samples. The mineralization pattern of microbial nitrogen was quite different in the non-fumigated samples. On the other hand, kinetic study of the mineral nitrogen flush obtained after chlofoform fumigation has been started for one soil; these first results showed that the nitrogen flush can be explained by mathematical relations.

12812 **Creating a new source of plant lipids.** Yermanos, D.M. (Univ. of California, Riverside). pp 250-256 of Biosynthesis and function of plant lipids. Thomson, W.W.; Mudd, J.B.; Gibbs, M. (eds.). Rockville, MD; American Society of Plant Physiologists (1983). (CONF-830156—).

From 6. annual botany and plant physiology symposium on biosynthesis and function of plant lipids; Riverside, CA, USA (13 Jan 1983).

The striking difference between jojoba oil and all other plant lipids is that jojoba oil is not a triglyceride but a wax ester between long carbon-chain fatty acids and fatty alcohols without the intervention of glycerol. The detailed alcohol/acid composition of jojba oil, the ester combinations in the oil, and the physical properties of the oil are given. The unique chemical composition and physical properties of this oil offered the promise that it could become a major commodity in the vegetable oil market. Jojoba seed was the native populations of the Sonoran Desert, where seed production is unpredictable and erratic. Jojoba would have to be domesticated and grown as a commercial crop on a large scale to ensure a dependable source of oil at a competitive price. A research project for such domestication was established in 1961 at the University of California in Riverside. Extensive data collection between 1961 and 1975, from native populations in the US and Mexico, offered a basic understanding about jojoba's environmental requirements.

56 BIOMEDICAL SCIENCES, APPLIED STUDIES

12813 (ACIESP—36-1, pp 294-316) **Modifications in the seric levels of total proteins of white giant rabbit by $YbCl_3$.** Rodrigues, N.L.; Novelli, E.L.B.; Rossi, C. (UNESP, Botucatu (Brazil). Inst. Basico de Biologia Medica e Agricola). 1982. (In Portuguese). NTIS (US Sales Only), PC A14/MF A01. (CONF-8111179—).

From 6. annual symposium of the ACIESP; Sao Paulo, Brazil (9 Nov 1981).

Biological effects of ytterbium, administered as a chloride are analysed. The influence on the seric levels of total - and fractions proteins is also presented.

5601 Radiation Effects On Animals

12814 (AD-A—130929/3) **Operation hardtack 2, 1958. Technical report.** Ponton, J.; Rohrer, S.; Maag, C.; Shepanek, R.; Gravitis, I. (JRB Associates, Inc., McLean, VA (USA)). 3 Dec 1982. 242p. NTIS, PC A11/MF A01.

This report describes the activities of an estimated 1,000 DOD personnel, both military and civilian, in Operation HARDTACK II, a nuclear testing series conducted in Nevada from 12 September to 30 October 1958. The series consisted of 37 events: 19 weapons tests and 18 safety experiments. DOD activities included scientific test participation, staff support, and air support. Radiological safety procedures were established and implemented to minimize individual radiation exposures.

12815 (AD-A—132941/6) **Duration of memory loss due to electron beam exposure. Final report Jan-May 1983.** Wheeler, T.G.; Tilton, B.M. (School of Aerospace Medicine, Brooks AFB, TX (USA)). Aug 1983. 12p. (SAM-TR—83-33). NTIS, PC A02/MF A01.

Electron beam exposure has been shown to produce retrograde amnesia (RA). The objective of this study was to determine the duration of memory loss upon electron beam exposure. It is important to know if exposure produces a memory loss of the events which occurred in the preceding 1 sec or memory loss of the preceding minute's events. The task was a single-trial avoidance paradigm. The animal was placed in a small aversive chamber. After a 90-sec adaptation period, a door opened that provided access to a large, dark, preferred chamber. The time required for the animal to enter the preferred chamber was the measure of interest (T). Once inside the preferred chamber, a 1-sec footshock was delivered. Following the footshock by some preset delay (delta T), the animal was exposed to a 10-microsec, 10-rad electron beam (or X-ray). A second trial on the task was run 2 hr postexposure. The second trial consisted of placing the animal in the aversive chamber and monitoring the time (T') required to enter the preferred chamber. If the electron beam exposure interfered with the animal's ability to recall the shock, T' would be greatly reduced as compared with the sham controls. The exposure delay times used were delta T = 1, 3, 5, and 10 sec.

5601 Radiation Effects On Microorganisms

12816 (CEA-CONF—6859) **Radiation processing of food.** Saint-Lebe, L.; Raffi, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Jun 1983. 10p. (In French). (CONF-8306154—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750450.

From Meeting of the South-French working group in nuclear medicine; Nice, France (7 Jun 1983).

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The ionizing radiations available for food processing are defined, their mode of action and principal effects are described. Toxicological studies (animal tests, radiochemistry) concerning irradiated food are reviewed. The characteristics of the irradiation procedure and the prospects of its industrial development in France are presented.

5601 Radiation Effects On Animals

12817 (CEA-CONF—6870) **^{64}Cu and krebs ascitic tumors in mice.** Grisvard, J.; Guille, E.; Sissoeff, I.; Apelgot, S.; Coppey, J.; Fromentin, A. (Paris-11 Univ., 91 - Orsay (France); CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Jul 1983. 2p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750455.

Published in summary form only.

5601 Radiation Effects

12818 (INIS-mf—8641) **Radiation biology II. Proceedings of national radiobiology conference.** Kalina, I. (ed.). (Ceskoslovenska Vedeckotechnicka Spolocnost, Kosice. Dom Techniky). Nov 1982. 108p. (In Czech). (CONF-8211110—Vol.2). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84780084.

From National radiobiology conference; Stary Smokovec, Czechoslovakia (21 Nov 1982).

Items within the scope of EDB have been entered individually into the data base. (ACR)

12819 **(NUREG—0683-Suppl.1(Draft)) Programmatic environmental impact statement related to decontamination and disposal of radioactive wastes resulting from March 28, 1979 accident, Three Mile Island Nuclear Station, Unit 2 (Docket No. 50-320). Draft supplement dealing with occupational radiation dose. Supplement No. 1.** (Nuclear Regulatory Commission, Washington, DC (USA). Three Mile Island Program Office). Dec 1983. 88p. NTIS, PC A05/MF A01 - GPO. Order Number DE84900666.

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In accordance with the National Environmental Policy Act, the Programmatic Environmental Impact Statement Related to Decontamination and Disposal of Radioactive Waste for the 1979 Accident at Three Mile Island Nuclear Station Unit 2 has been supplemented. The supplement was required because current information indicates that cleanup will entail substantially more occupational radiation dose to the cleanup work force than originally anticipated. Cleanup was originally estimated to result in from 2000 to 8000 person-rem of occupational radiation dose. Although only 1700 person-rem have resulted from cleanup operations performed up to now, current estimates now indicate that between 13,000 and 46,000 person-rem are expected to be required. Alternate cleanup methods considered in the supplement either did not result in appreciable dose savings or were not known to be technically feasible.

12820 **(NUREG—1060) Answers to questions about updated estimates of occupational radiation doses at Three Mile Island, Unit 2.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Dec 1983. 25p. NTIS, PC A02/MF A01 - GPO $3.25. Order Number DE84900670.

The purpose of this question and answer report is to provide a clear, easy-to-understand explanation of revised radiation dose estimates which workers are likely to receive over the course of the cleanup at Three Mile Island, Unit 2, and of the possible health consequences to workers of these new estimates. We will focus primarily on occupational dose, although pertinent questions about public health and safety will also be answered.

5601 Nuclide Kinetics And Toxicology

12821 **(NUREG/CR—3454) Bioassays using resonance ionization spectroscopy.** Parks, J.E. (Atom Sciences, Inc., Oak Ridge, TN (USA)). Nov 1983. 29p. NTIS, PC A03/MF A01 - GPO $3.75. Order Number DE84900713.

This report addresses the possible use of Sputter-Initiated Resonance Ionization Spectroscopy for analysis of uranium, plutonium and thorium in urine (principally), blood and feces. The method appears capable of performing such analyses on urine down to levels of 0.05 microgram uranium per liter or lower at reasonable cost and with good accuracy. A preliminary chemical separation would be required, as with most other methods. Anion exchange from strong HCl solution appears highly satisfactory for the separation. No method capable of distinguishing between isotopes of the same element can be employed without chemical pretreatment that is at least as extensive. The experimental steps necessary to verify these conclusions are indicated.

5601 Radiation Effects On Animals

12822 **(PB—84-935500) Radiation carcinogenesis. Cancergram ck06.** (National Cancer Inst., Bethesda, MD (USA). International Cancer Research Data Bank). 1984. 12 issuesp. Paper copy available on subscription, North American Continent price $30.00/year; all others write for quote. Also available in single copies.

The Cancergram deals with all aspects of radiation carcinogenesis. The term 'radiation' here includes U-V radiation and the entire electromagnetic spectrum, electron and other charged particle beams, neutrons and alpha and beta radiation from radioactive substances. Abstracts included concern relationships between radiation and carcinogenesis in humans, experimental induction of tumors in animals by irradiation, studies on the mechanism of radiation carcinogenesis at the cellular level, studies of RBE, dose response or dose threshold in relation to radiation carcinogenesis, and methods and policies for control of radiation exposure in the general population. In general, this Cancergram excludes abstracts on radiotherapy, radiologic diagnosis, radiation pathology, and radiation biology, where these articles have no bearing on radiation carcinogenesis.

12823 **(PB—84-936100) Organ site carcinogenesis: mammary gland. Cancergram ck12.** (National Cancer Inst., Bethesda, MD (USA). International Cancer Research Data Bank). 1984. 12 issuesp. Paper copy available on subscription, North American Continent price $30.00/year; all others write for quote. Also available in single copies.

The Cancergram covers the occurrence, etiology, and introduction of mammary cancer in both humans and experimental animals. The roles of chemical and physical agents, exogenous and endogenous hormones, viral and infectious agents, individual personal practices, and genetic and constitutional states are all considered under the etiology and induction of tumors. The Cancergram also includes studies of possible mechanisms of carcinogenesis, cancer prevention measures, and immunological, biochemical, physiology, and morphological aspects of carcinogenesis in the breast. General studies of cancer biochemistry, immunology, physiology, or morphology, are included on a selective basis. This Cancergram generally excludes studies of diagnosis, treatment, and pathology of breast cancer, as these topics are covered by Cancergram CT09.

5601 Radiation Effects On Cells

12824 **(PNL-SA—11687) Introduction and rapporteur of posters.** Nelson, J.M. (Pacific Northwest Lab., Richland, WA (USA)). Jul 1983. Contract AC06-76RL01830. 10p. (CONF-830782—3). NTIS, PC A02/MF A01. Order Number DE84005889.

From 11. L. H. Gray conference on cellular repair of radiation damage - mechanisms and modifying agents; Glasgow, UK (18 Jul 1983).

This paper summarizes 31 posters presented at the 11th L.H. Gray Conference. The subject areas include: (1) cell-to-cell contact; (2) fractionated radiation and repair; (3) the production of chromosomal aberrations; (4) biological repair; (5) redox potentials after irradiation; (6) low dose rate studies; and (7) the influence of cell kinetics on radiation response.

12825 **Cells at risk for the production of bone tumors in radium exposed individuals: an electron microscope study.** Lloyd, E.L.; Henning, C.B. (Argonne National Lab., IL). *Health Physics;* **44**: No. Sup. 1, 135-148(1983).

The endosteal cells of bone from a 75-yr-old woman who had acquired radium internally, as a consequence of her previous employment as a radium dial painter, are documented here for the first time by electron microscopy. As a result of amputation for a fibrosarcoma in the region of the right knee joint, fresh samples of bone and tumor tissue from the femur were made available. A sample of bone, also obtained at amputation from an unirradiated control patient, age 65, was examined from the same site in the femur. A comparison of the bone-marrow interface from the two patients showed that, unlike the control bone where cells were seen close to bone mineral a fibrotic layer was interposed between the marrow cells and the bone mineral in the bone from the radium case. This layer varied in thickness up to 50 μm and was often acellular, although cell remnants and cells, which appeared viable, were sometimes seen within this layer. It is suggested that irradiation of those cells proliferating within, and at the edge of, this replacement fibrotic layer may be the most important in the induction of bone tumors rather than the original cells lying within the 0-10 μm range from bone mineral which has previously been supposed. The nuclear dimensions of the endosteal bone lining cells and their distance from bone mineral have been measured in the bones from the radium and control cases. These dimensions are important not only in understanding the mechanisms by which bone tumors arise but in developing models of carcinogenic risks of other α-particle emitting isotopes such as plutonium.

12826 **Plugged haversian canals and local dose in radium cases.** Simmons, D.J. (Washington Univ. School of Medicine, St. Louis, MO); Holtzman, R.B. *Health Physics;* 44: No. Sup. 1, 179-186(1983).

Haversian canal plugging is a common lesion in bone from human radium cases, signaling vascular damage. Its incidence is correlated with the whole body radium dose. However, since the vascular supply to bone forms an extensive anastomotic plexus facilitating propagation of vascular damage from a primary site of high radium content, we do not know if the degree of plugging is related to the local bone dose. In this report, we compare the incidence of plugging of osteons in different regions (16 sections) of humeri of three radium cases with terminal ^{226}Ra body contents of 0.203, 1.03 and 15.4 μCi to the local dose of radium in adjacent bone sections. While the first and third subjects had received ^{226}Ra only, the second had had a large intake of ^{228}Ra as well. The background incidence of plugging in 35 "normal" humeri from dissecting room populations (45-90 yr) ranged from 0 to 1%, with an average of 0.3%. The least squares linear regression equation for the relation between the percent of canals plugged (PCP) and dose predicts for our three radium cases a development of about 0.002% plugs/rad. The correlation coefficient was very high. When normalized to radiation dose from the two decay series, ^{226}Ra and ^{228}Ra appear to be equally effective in producing plugged canals.

12827 **Long term health effects of thorium compounds on exposed workers: the complete blood count.** Conibear, S.A. (Argonne National Lab., IL). *Health Physics;* 44: No. Sup. 1, 231-237(1983).

Two hundred seventy-three men exposed to thorium and other rare earths between 1940 and 1973 at a plant which refined monazite sand were studied at Argonne National Laboratory from 1976 to 1980. In vivo measurements of body burden were made by counting γ rays emitted by daughter products of retained thorium and by measuring exhaled thoron. Health status was ascertained through questionnaire, physical examination, and clinical laboratory tests. Measured body burden was found to be higher in those with a history of longer exposure. All parameters of the complete blood count were examined for evidence of an effect due to thorium. Comparisons of high and low body groups showed that only age and cigarette smoking had an effect on complete blood count parameters.

12828 **Mortality among male workers at a thorium-processing plant.** Polednak, A.P.; Stehney, A.F.; Lucas, H.F. (Argonne National Lab., IL). *Health Physics;* 44: No. Sup. 1, 239-251(1983).

The long-term health effects of exposure to thorium are of interest because of the possible increased use of thorium as an energy source in reactors using ^{232}Th to produce ^{233}U. Mortality is described in a cohort of 3039 men who were employed between 1940 and 1973 at a company involved in the production of thorium and rare earth chemicals from monazite sand. Based on deaths ascertained by the Social Security Administration and mortality rates for U.S. white males, the standardized mortality ratio (SMR) for all causes was 1.05 with 95% confidence limits (95% CL) of 0.96 and 1.15. Much of the excess mortality was attributable to non-occupational motor vehicle accidents (SMR = 1.64; 95% CL = 1.16 and 2.23), but SMRs were also high for lung cancer (1.44; 95% CL = 0.98 and 2.02), pancreatic cancer (2.01; 95% CL = 0.92 and 3.82), and diseases of the respiratory system (1.31; 95% CL = 0.92 and 1.83). In a subgroup of 592 men who worked for at least one year in selected jobs (indicative of highest exposure to thorium and thoron) that was followed up more intensively, the SMR for pancreatic cancer was significantly elevated (i.e. 4.13; 95% confidence limits = 1.34 and 9.63). The SMR for lung cancer was 1.68 (95% CL = 0.81 and 3.09), while that for respiratory diseases was 1.20 (95% CL = 0.52 and 2.37). Information on smoking habits in a sample of survivors suggested that smoking could have explained at least part of the excess mortality from lung and pancreatic cancer and from diseases of the respiratory system. Continued follow-up of the cohort through morbidity and mortality studies is needed to evaluate further the possible long-term effects of exposure to radioactivity and chemicals in the thorium extraction process.

12829 **Effects of Thorotrast in humans.** Stover, B.J. (Univ. of North Carolina at Chapel Hill). *Health Physics;* 44: No. Sup. 1, 253-257(1983). Contract AC02-76EV00119.

Thorotrast, a patented radiological contrast medium that was widely used from 1930-1950, is a thorium dioxide colloid that has been neutralized and stabilized by protective colloids, which are decomposition products of starch, and which are now generally known as dextrans. The deposition of Thorotrast depends on its radiological use, its method of preparation, and the age of the preparation; however, the major site is the reticuloendothelial system (RES), where it is retained for long times. Some of its decay products, principally ^{228}Ra and ^{224}Ra, escape from the colloidal particles and deposit in the skeleton. The biological end points that have been observed in the several human populations that are known to have received Thorotrast are Thorotrastomas, malignant hepatic neoplasms, and other neoplasms of the RES, skeletal sarcomas, and leukemias in excess of the number expected. The question to be reviewed in this paper is whether irradiation, or chemical and mechanical effects on the reticuloendothelial system, or a combination thereof, is the causative factor in the occurrence of these RES neoplasms.

12830 **Lifetime bone cancer dose-response relationships in beagles and people from skeletal burdens of ^{226}Ra and ^{90}Sr.** Raabe, O.G.; Book, S.A.; Parks, N.J. (Univ. of California, Davis). *Health Physics;* 44: No. Sup. 1, 33-48(1983). Contract AC03-76SF00472.

The life-time tumor dose-response relationships observed in beagles injected with ^{226}Ra or fed ^{90}Sr at the University of California, Davis, provide a basis for understanding the induction of bone cancer for these bone-seeking radionuclides and for scaling to people. In these studies 385 dogs were exposed to graded dosage levels of ^{90}Sr and 243 dogs were exposed to graded dosage levels of ^{226}Ra with a total of 159 unexposed controls. The results show different dose-response relationships for bone cancer for the two radionuclides based upon the gravimetric average dose rates and cumulative doses to bone. These relationships were found to be well represented by three-dimensional log-normal dose-response surfaces that yield risk as a function of average dose-rate and time after beginning of exposure. All dose-rates suggested a 100% risk at some later time post-exposure but the time required to reach a given level of risk was long for low dose rates so that there exists a practical threshold in that at lower dose rates individuals may die spontaneously from causes associated with natural aging prior to the expected appearance of radiogenic cancer. The risks to people at various ^{226}Ra body burdens (average skeletal dose rates) are estimated based on the model.

12831 **Leukaemia incidence in the U.S. dial workers.** Spiers, F.W.; Lucas, H.F.; Rundo, J.; Anast, G.A. (Argonne National Lab., IL). *Health Physics;* 44: No. Sup. 1, 65-72(1983).

Late biological effects of radium deposited in the human skeleton have manifested themselves unequivocally as osteogenic sarcomas or carcinomas of the mastoid air cells or paranasal sinuses. On the basis of current estimated risk factors, it might be expected that an excess of certain other malignancies could occur in a population of the size of the group exposed to radium (some 3500 cases located, of which more than 2000 have measured ^{226}Ra and ^{228}Ra burdens), compared with the incidence in the population at large. An increased incidence of breast cancer has already been reported in female dial workers and it was related to the initial radium intake. On the other hand, very little information is available on the induction of leukemia by α-radiation in human bone marrow. This paper therefore reports an investigation of the incidence of leukemia among the radium workers. This covers a very wide range of radium burdens and has been done in the light of reasonable estimates of the mean α-particle dose received by the skeletal haemopoietic marrow. The number of leukemia cases is identified and compared with (a) the expected number in a comparable population of the same size and age distribution and (b) predictions based on the risk factor proposed for protection purposes by the ICRP and on the estimated bone marrow doses.

12832 **Survey of ocular cataracts in radium dial workers.** Adams, E.E.; Brues, A.M.; Anast, G.A. (Argonne National Lab., IL). *Health Physics;* 44: No. Sup. 1, 73-79(1983).

A survey of the medical records of 813 female radium dial workers first exposed to radium before 1930 yielded reports of 119 cataracts in the group whose radium body burden had been measured at least once. After dividing the subjects into high and low dose groups, the data were analyzed according to latency (time between first employment and first diagnosis of cataract), duration of employment and age at first exposure. Duration of employment and age at employment showed no significant correlation with dose. Latency, however, showed a significant negative correlation with dose. Since radiation cataracts tend to occur earlier than so-called senile cataracts, these preliminary data suggest the need for further investigation.

12833 **Comparative pathogenesis of radium-induced intracortical bone lesions in humans and beagles.** Pool, R.R. (Univ. of California, Davis); Morgan, J.P.; Parks, N.J.; Farnham, J.E.; Littman, M.S. *Health Physics;* 44: No. Sup. 1, 155-177(1983).

Morphologic changes resulting from the effects of chronic radionuclide toxicity (^{226}Ra) in the skeletons of workers in the radioluminescent dial painting industry with preterminal body burdens ranging from about 1.5 to 0.042 μCi were compared with the pathologic alterations in the skeletons of a group of 38 beagle dogs injected with 1.12 μCi/kg. Similarities observed in the skeletal responses of the two species were the presence of (1) dead bone tissue with delayed resolution, (2) a chronic disturbance in the remodeling mechanism of bone tissue, and (3) radiation-induced bone sarcomas. A detailed analysis of sequential changes in radiographic lesions arising in the beagle skeletons, complemented by histopathologic evaluation at the time of limb amputation or at necropsy, has enabled us to examine the disturbance in the bone remodeling process. The perturbation of critical importance in the generation of primary bone tumors appears to lie in the bone tissue formation and deposition phase of the bone remodeling process and gives rise to a spectrum of histologic patterns which we have termed "radiation osteodystrophy." While some of the newly generated patterns demonstrate indolent behavior with fibrous tissue replacement and bone marrow refill, other sites of bone resorption are replaced by a unique fibro-osseous tissue response resembling fibrous dysplasia or osteoblastoma. Some of these proliferative lesions may undergo progressive malignant degeneration. While the more indolent part of the spectrum was also seen in human skeletal tissues, only premalignant and early sarcomatous stages were seen in canine tissues.

5601 Nuclide Kinetics And Toxicology

12834 **Distribution and retention in bone of ^{226}Ra and comparison with the ICRP 20 model.** Holtzman, R.B.; Rundo, J.; Sha, J.Y.; Spaletto, M.I. (Argonne National Lab., IL). *Health Physics;* 44: No. Sup. 1, 123-133(1983).

Analyses are presented of the ratios of ^{226}Ra to calcium in over 650 samples of compact and cancellous bone from 66 female and 26 male subjects who had died from less than 1 to 60 yr after first exposure to radium. The ^{226}Ra/Ca ratios were normalized to the terminal ^{226}Ra skeletal content. The ^{226}Ra/Ca ratios for vertebrae were essentially identical to those for other cancellous bone for a given subject. Comparisons of the data with predictions of the ICRP model of alkaline earth metabolism show that for female cancellous bone the normalized ^{226}Ra/Ca ratios tended to be greater than predicted, while those for female cortical bone (femoral and tibial shaft) tended to be less. The data for males were fitted better by the model. A modification of the model to reduce the amount of radium deposited in soft tissue fitted the data better in some respects. A straight line linear least squares fit to the data appeared to fit as well as, or better than, the models. A radiation effect was suggested in that the normalized ^{226}Ra/Ca ratio for vertebrae relative to the ratio expected increased with skeletal absorbed dose for vertebrae. However, no such effect was apparent for compact bone or for the cancellous bone as a whole.

12835 **Consideration of age-dependent radium retention in people on the basis of the beagle model.** Parks, N.J. (University of California, Davis); Keane, A.T. *Health Physics;* 44: No. Sup. 1, 103-112(1983).

This paper examines in humans the proposition emanating from studies in beagles that initial retention of radium varies in proportion to the calcium addition rate at the time of intake. Human calcium addition rates were scaled from those in beagles, the relative calcium accretion rates in the two species at equivalent stages of skeletal growth providing the scaling factor. The variation of radium retention with age was determined by fitting a modified power function to data on the retention of radium from about 30 to 15000 days following a series of therapeutic injections of ^{226}Ra in humans ranging in age from 18 to 63 yr.

12836 **The U.S. Uranium Registry tissue program.** Moore, R.H.; Breitenstein, B.D. Jr. (Hanford Environmental Health Foundation, Richland, WA). *Health Physics;* 44: No. Sup. 1, 373-376(1983).

The U.S. Uranium Registry tissue program was established in December 1980. It is patterned after the U.S. Transuranium Registry program. Both are funded by DOE. The objectives of the program are to: (1) detect the presence and distribution of uranium, if any, in human tissue in occupationally exposed workers, (2) compare bioassay and in vivo measurements for exposed individuals with the results of analysis of tissue obtained at autopsy, (3) seek evidence of histopathological changes related to any uranium deposition found, (4) conduct analyses of whole bodies, when available, to obtain more precise data on the uranium burdens, if any, in the body and organs, and especially the distribution in parts of the body, such as most of the skeleton, that are not usually accessible for sampling. The program will include (1) participants who have been permissibly exposed, (2) participants who were exposed at a time when current limits did not exist and (3) reference individuals without exposure. The program will develop data that will assist in evaluating (1) the accuracy of current in vivo measurement techniques, (2) the propriety of existing regulations and (3) the adequacy of current protection programs. Enrollment in the program is voluntary.

5601 Radiation Effects On Animals

12837 **Treatment of cancer with heavy charged particles.** Castro, J.R.; Saunders, W.M.; Tobias, C.A.; Chen, G.T.Y.; Curtis, S.; Lyman, J.T.; Collier, J.M.; Pitluck, S.; Woodruff, K.A.; Blakely, E.A. (Univ. of California, Berkeley). *International Journal of Radiation Oncology, Biology and Physics;* 8: No. 12, 2191-2198(Dec 1982). Contract W-7405-ENG-48.

A clinical radiotherapeutic trial using heavy charged particles in the treatment of human cancers has accrued over 400 patients since 1975, 378 of whom were treated with particles and 28 with low LET photons as control patients. Heavy charged particle radiotherapy offers the potential advantages of improved dose localization and/or enhanced biologic effect, depending on particle selected for treatment. Target sites have included selected head and neck tumors, ocular melanomata, malignant gliomata of the brain, carcinoma of the esophagus, carcinoma of the stomach, carcinoma of the pancreas, selected juxtaspinal tumors and other locally advanced, unresectable tumors. A Phase III prospective clinical trial has been started in carcinoma of the pancreas using helium ions. Phase I-II studies are underway with heavier particles such as carbon, neon and argon ions in order to prepare for prospective Phase III trials. Silicon ions are also under consideration for clinical trial. These studies are supported by the United States Department of Energy and National Institutes of Health.

5602 Thermal Effects

12838 **(PB—84-100122) Biochemical indicators of thermal stress: selected genetic and physiological parameters. Final report.** Powers, D.A. (Johns Hopkins Univ., Baltimore, MD (USA)). May 1983. 80p. NTIS, PC A05/MF A01.

The model species Fundulus heteroclitus was sampled from the intake and thermally elevated discharge water of five power plants and twenty-five other areas in the Chesapeake Bay which are not associated with power plants. Genetic and physiological measurements were made on sampled populations and differences correlated with environmental temperature, oxygen and/or salinity. Finally, attempts to sort out some of these variables were made by employing laboratory experiments at the whole organism, cellular, and biochemical levels.

12839 **(PB—84-101344) Thermal tolerance of aquatic insects inhabiting the Tennessee river-reservoir system. Final report.** Tennessen, K.J.; Miller, J.L. (Tennessee Valley Authority, Muscle Shoals, AL (USA). Office of Natural Resources). May 1983. 78p. NTIS, PC A05/MF A01.

In laboratory tests, nymphs of Hexagenia bilineata (Ephemeroptera) and larvae of Chironomus crassicaudatus (Diptera) were highly tolerant of short term thermal shocks (six hour duration, simulating entrainment in a thermal plume and drifting to ambient). TL^{50} values increased from 35C at an acclimation temperature of 5C to 38-40C at an acclimation temperature of 20-25C. However, survivors of these treatments experienced higher percentages of delayed mortality compared to controls after being held for ten days to four weeks at the original acclimation temperature. Field data generated indicated that aquatic insect species inhabiting TVA's large warm-water reservoirs are living close to their thermal maximu, and that an upper limit of 33C would ensure the maintenance of sizeable populations of the species studied.

12840 **Effect of temperature and sex on growth patterns in nymphs of the mayfly Hexagenia bilineata in the laboratory.** Wright, L.L.; Mattice, J.S.; Beauchamp, J.J. (Oak Ridge National Lab., TN). *Freshwater Biology;* **12**: 535-545(1982). Contract W-7405-ENG-26.

Eggs collected from Hexagenia bilineata females were successfully reared in the laboratory at temperatures of 15, 20, 25 and 30°C. Eggs did not hatch at 10°C and although hatching was successful at 35°C, all nymphs at this temperature died while in early instars. Survival of nymphs between the approximate size interval of 4-14 mm showed a significant decrease with increased temperatures. Nymphs at 15°C, however, generally did not survive transformation to the subadult stage. The growth pattern of individual nymphs was well described by a logistic curve at most temperatures. Furthermore, growth pattern was significantly affected by both temperature and sex. Rate of development from oviposition to first emergence increased with increasing temperatures in a linear fashion between 15 and 30°C. The relationship was equally well described by a hyperbolic equation, the lower threshold temperature for development was estimated to be 10.1°C+/-3.1°C. The degree (°C)-days required for development from oviposition to first emergence was calculated to be 2337 days with 95% confidence limits of 2045-2727 days under laboratory conditions.

5603 Chemicals Metabolism And Toxicity

12841 **(AD-A—132942/4) Studies in a rat lung tumor model: cellular biochemistry and cytogenetics. Annual report No. 3, 1 July 1982-30 June 1983.** Rasmussen, R.E. (California Univ., Irvine (USA). Dept. of Community and Environmental Medicine). Aug 1983. 26p. NTIS, PC A03/MF A01.

Dose-response relationships were established for the induction of 3-methylcholanthrene (MCA) of squamous cell carcinomas (SCC) in rat lung. Five biweekly intratracheal inoculations of 0.25, 0.5, 1.0, or 5.0 mg MCA gave tumor yields of 8%, 16%, 48%, and 100%, respectively, in treatment groups of 25 rats each. No tumors were seen in control rats or in rats treated 5 times with 0.1 mg MCA. Studies of sister chromatid exchange (SCE) incidence in lung cell cultures and in peripheral lymphocytes of rats treated intratracheally with tumorigenic doses of MCA showed elevated frequencies of SCEs in the lung cells, but not in peripheral lymphocytes. The increased level of SCEs in the lung cells did not persist, but declined in parallel with the clearance of MCA from the lungs over a period of about 6-8 weeks. The conclusions were that SCE incidence in peripheral lymphocytes could not be used to predict a carcinogenic hit in the lung as the result of MCA treatment, and the elevation of SCE frequency in lung cells was dependent on the presence of MCA immediately prior to performing the assay. Preliminary results of studies in which rats were treated with MCA and/or asbestos indicated that cytotoxic effects in the lung were different for the 2 materials. MCA tended to produce lesions at the terminal bronchioles and asbestos caused focal areas of fibrosis. Experiments in progress will indicate whether a cocarcinogenic action of the materials may occur in the rat lung tumor model.

12842 **(AD-A—132943/2) Comparative biochemistry and metabolism. Part 2. naphthalene lung toxicity. Annual report, July 1982-June 1983.** Buckpitt, A.R. (California Univ., Irvine (USA). Dept. of Community and Environmental Medicine). Aug 1983. 42p. NTIS, PC A03/MF A01.

Previous studies have shown that intraperitoneal administration of naphthalene to mice results in dose-dependent necrosis of pulmonary bronchiolar epithelial cells but not in hepatic or renal damage. Several factors have supported a relationship between the cytochrome P-450 mediated formation of reactive naphthalene metabolites and the bronchiolar epithelial damage. Reactive metabolites from naphthalene become bound covalently to macromolecules in the lung in a dose and time dependent fashion and pretreatments which alter the severity of bronchiolar damage alter the pulmonary covalent binding in a parallel fashion. However, the observed target organ specificity for naphthalene-induced cytotoxicity is not reflected in the preferential covalent binding of reactive metabolites in the target tissue in vivo nor is it reflected in substantially higher rates of pose of the studies outlined in this annual report was to develop a method for examining the chemical nature of reactive metabolites produced in microsomes from target and nontarget tissues and to determine whether differences in the kinetics of formation of a particular reactive metabolite correlate with the highly species and organ specific toxicity of naphthalene.

12843 (GSF-A—3/83, pp 3-7) **Mechanism of the effect of nuisances on ecosystems of forests.** Zoettl, H.W. Apr 1983. (In German). Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). (CONF-830159—).

From Seminar of Gesellschaft fuer Strahlen- und Umweltforschung on SO/sub 2/ and the consequences; Munich, F.R. Germany (20 Jan 1983).

Air pollutants having a synergistic effect on the assimilation organs (e.g. SO_2) cause chlorophyll decomposition and washing out of very mobile elements such as Mg, K, Zn, and Mn. The trees try to compensate such losses by an increased uptake of nutrients. Their supply with N and P continues to be excellent even if they are damaged. The results are differences in the deficiency symptoms. Aimed fertilizing measures are expected to help mitigate the damage.

12844 (GSF-A—3/83, pp 9-13) **Working hypothesis on spruce sickness in higher regions of the Bavarian Forest.** Rehfuess, K.E. Apr 1983. (In German). Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). (CONF-830159—).

From Seminar of Gesellschaft fuer Strahlen- und Umweltforschung on SO/sub 2/ and the consequences; Munich, F.R. Germany (20 Jan 1983).

The inadequate supply of above all sick trees with magnesium and calcium might be due to an increased washing out of both elements from the needles. That is to say, sulfuric acid (nitric acid) precipitated on or formed in the needles after SO_2 influx is capable of lowering the Ca and Mg levels unless rapid compensation from the soil by increased uptake via the roots is possible. This washing out of alkaline earth metal compounds from the needles is probably favoured by such damage of the cell membranes as SO_2, frost or photooxidants can cause it. Magnesium deficiency apparently is associated with reduced frost hardness so that heavy frost to which incompletely hardened trees are exposed after warm periods is particularly harmful.

12845 (GSF-A—3/83, pp 15-30) **Ecosystem aspects of the emision of anhydrides of strong acids.** Ulrich, B. Apr 1983. (In German). Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). (CONF-830159—).

From Seminar of Gesellschaft fuer Strahlen- und Umweltforschung on SO/sub 2/ and the consequences; Munich, F.R. Germany (20 Jan 1983).

The notion of air pollutant deposition (acid rain) includes all possible acute, chronic, direct and indirect effects. It also includes the toxic effects of the acid anhydrides SO_2 and NOsub(x), of HF and organic compounds with acid character as well as photo oxidants, to which, e.g., peroxy acids belong. The chemical principle underlying the various effects is the reactivity of the acid anhydrides SO_2 and NOsub(x).

12846 (GSF-A—3/83, pp 31-47) **Ecophysiological consequences of low but prolonged SO_2 concentrations on some types of forest trees.** Keller, T. Apr 1983. (In German). Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). (CONF-830159—).

From Seminar of Gesellschaft fuer Strahlen- und Umweltforschung on SO/sub 2/ and the consequences; Munich, F.R. Germany (20 Jan 1983).

For various reasons trees, in the long run, belong to the most SO_2-sensitive plants. In a quantitative respect, speaking first of all of yield, it was found that SO_2 impairs the uptake of CO_2 and, thereby, the basic factor for any substance production of our trees. The investigation showed that a reduced CO_2 uptake can entail a reduced cell number in the annual ring spelling a less substantial production of wood. The same can occur owing to winter furnigation or in the absence of any outwardly visible symptoms of exposure. The formation and growth of roots can be impaired in the year following the SO_2 influence. The qualitative consequences of the SO_2 action consist in reduced vitality and increased proneness to disease.

12847 (GSF-A—3/83, pp 49-57) **Biological alterations in the trunck and roots of forest trees exposed to nuisances.** Bauch, J. Apr 1983. (In German). Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). (CONF-830159—).

From Seminar of Gesellschaft fuer Strahlen- und Umweltforschung on SO/sub 2/ and the consequences; Munich, F.R. Germany (20 Jan 1983).

The comparative analyses of needles, wood tissue and roots suggest that the exposure of the crown to polluted air is not solely responsible for the damage. The drastic back-formation of the roots concomitantly with Ca and Mg in acid soils is also at least partly responsible. The effect of Al on the cells of the fine roots has not yet been elucidated. As regards fir-trees and spruces, annual ring analyses and dendroclimatological investigations have shown the growth deficit to date partly many years back.

12848 (GSF-A—3/83, pp 105-112) **Peroxide problems.** Elstner, E. Apr 1983. (In German). Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). (CONF-830159—).

From Seminar of Gesellschaft fuer Strahlen- und Umweltforschung on SO/sub 2/ and the consequences; Munich, F.R. Germany (20 Jan 1983).

Although from the viewpoint of plant toxicology a classification of air-pollutant components does not make sense, these are divided into oxidative and reductive smog, acids, dusts, phytoeffectors and allelopathic effectors. SO_2, which occurs in nearly all groups, can form an alkoxy radical and a sulfite radical with peroxide. The alkoxy radicals can then for instance cooxidate, and thereby bleach, chlorophyll. In a rather complex relation involving the superoxide anion, the bleaching reaction can be explained, too. Chlorophyll bleaching thus becomes dependent on a peroxide and a sulfite.

12849 (GSF-A—3/83, pp 113) **Metabolic effect of SO_2 in combination with nitrite.** Holzer, H.; Hinze, H.; Beck, I.; Maier, K. Apr 1983. (In German). Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). (CONF-830159—).

From Seminar of Gesellschaft fuer Strahlen- und Umweltforschung on SO/sub 2/ and the consequences; Munich, F.R. Germany (20 Jan 1983).

SO_2 damages the energy metabolism of bacteria, yeasts, and mammalian tissue by a rapid and drastic lowering of intracellular ATP. In the entire animated nature ATP is the key substance of the cellular metabolism for all energy-producing and energy-consuming processes. In a model experiment with yeast cells it is demonstrated that also nitrogen oxides (used as nitrites) in low concentration damage the energy metabolism by lowering the intracellular ATP level. Sulfite and nitrogen oxides, in combination, have not an additive but a multiplicating effect.

12850 (GSF-A—3/83, pp 115-116) **Biochemical investigations of the action of air-polluting compounds - are they of any practical importance.** Ziegler, I. Apr 1983. (In German). Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). (CONF-830159—).

From Seminar of Gesellschaft fuer Strahlen- und Umweltforschung on SO/sub 2/ and the consequences; Munich, F.R. Germany (20 Jan 1983).

By the example of SO_2, the paper analyses the contribution of biochemical analysis. Like all harmful compounds SO_2 causes an ethylene and ethane production in the plants permitting a quantitative assessment of harmful effects. One of the characteristic actions of SO_2 is based on the fact that it competes with atmospheric CO_2 for the bonding points at the CO_2-fixing enzymes in the plant, viz. ribulose biphosphate carboxylase and phosphoenol pyruvate carboxylase (competitive inhibition), thereby inhibiting the fixation of CO_2, which leads to an impaired carbohydrate synthesis in the plant. Resistance to SO_2 is to a large extent biochemically dependent on the capacity for processing sulfur and the degree of sulfur supply from other sources. Industrial SO_2 frequently has a higher delta-^{34}S-value than the natural sulfur sources of the plant. A determination of the delta-^{34}S-value could be of use above all in locating focuses in cases of long-range SO_2 transport.

12851 (GSF-A—3/83, pp 117-124) **Effect of SO_2 on the metabolism of microorganisms.** Maier, K.; Hinze, H.; Leuschel, L.; Holzer, H. Apr 1983. (In German). Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). (CONF-830159—).

From Seminar of Gesellschaft fuer Strahlen- und Umweltforschung on SO/sub 2/ and the consequences; Munich, F.R. Germany (20 Jan 1983).

Acid pH-values account for an uptake of sulfite by yeast cells as a function of the outside concentration. At pH 3.6, sulfite causes in yeast a lowering of the nucleoside tri- and diphosphate levels. Sulfite inhibits glycolysis either by binding the acetaldehyde or by modification of NAD, entailing inhibition of GAPDH. In vitro and in vivo results with yeast lead one to suppose that the ATP-reducing effect under the condition of oxidative phosphorylation is due to an activation of adenosine triphosphatase. The antimicrobial effect of sulfite in such concentrations as used to preserve foodstuffs is due to an influence on the energy metabolism that is turned visible and measurable by a dramatic fall in ATP concentration.

12852 (GSF-A—3/83, pp 125-133) **Effect of SO_2 on the energy metabolism of mammalian tissues.** Beck, I.; Hinze, H.; Holzer, H.; Maly, F.E. Apr 1983. (In German). Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). (CONF-830159—).

From Seminar of Gesellschaft fuer Strahlen- und Umweltforschung on SO/sub 2/ and the consequences; Munich, F.R. Germany (20 Jan 1983).

Lung tissue and phagocyte cells like alveolar macrophages, peritoneal macrophages, copper cells and granulocytes, in contrast with liver tissue and hepatocytes, contain no measurable sulfite oxidase activity. Sulfite is capable of inducing, mainly in tissue and

cells without sulfite oxidase activity such as for instance lungs and macrophages, a strong decrease in ATP, and modifying physiological (demonstrated by the example of granulocytes). It should be examined whether a connection exists between the just mentioned findings and an increased rate of incidence of bronchial diseases at high SO_2 levels in air.

12853 (GSF-A—3/83, pp 135-155) **Translocation of aerosol particles in human lungs.** Heyder, J.; Gebhardt, J.; Stahlhofen, W. Apr 1983. (In German). Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). (CONF-830159—).

From Seminar of Gesellschaft fuer Strahlen- und Umweltforschung on SO/sub 2/ and the consequences; Munich, F.R. Germany (20 Jan 1983).

The deposition of particles in the human respiratory tract is a complex function of particle characteristics and respiratory parameters. It determines the maximum permissible concentrations to be laid down for pollutants in the atmosphere next to the surface and for dosification in aerosol therapy. The paper relates what is known about particle translocation in the respiratory tract, the experimental methods, and the determination of the deposition in the lungs and respiratory paths.

12854 (GSF-A—3/83, pp 157-167) **Effect of SO_2 and cigarette smoke on the mucociliary clearance of the lungs.** Stahlhofen, W.; Gebhart, J.; Heyder, J. Apr 1983. (In German). Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). (CONF-830159—).

From Seminar of Gesellschaft fuer Strahlen- und Umweltforschung on SO/sub 2/ and the consequences; Munich, F.R. Germany (20 Jan 1983).

Between the manifestations after H_2SO_3, SO_2, and cigarette smoke there is great similarity. Slight concentrations of these toxic agents accelerate the instantaneous course of mucociliary clearance, while increased concentrations account for a retardation. With quasi-continuous, permanent exposure of lungs to these agents the mean mucociliary clearance becomes retarded. There are signs of asthmatics and bronchitic patients reacting more sensitively to inhalation of H_2SO_4 and SO_2 than persons with normal respiratory function. Therefore the fixing of maximum concentration values for these agents in the atmosphere requires special consideration of this group of persons.

12855 (GSF-A—3/83) **SO_2 and the consequences.** (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.)). Apr 1983. 169p. (In German). (CONF-830159—). Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.).

From Seminar of Gesellschaft fuer Strahlen- und Umweltforschung on SO/sub 2/ and the consequences; Munich, F.R. Germany (20 Jan 1983).

Some questions in connection with the effect of SO_2 alone and in combination with peroxide and nitrite on plants, especially the leaves and roots, are answered. The analysis includes the effect of SO_2 on the energy metabolism of microorganisms and mammalian tissues (human lungs). The consequences of environmental protection measures for large furnaces on the energy economy are also pointed out. The 14 lectures of the seminar are individually covered.

12856 (NP—4770087) **Effects of the heavy metals cadmium, zinc, lead, and mercury on yeasts of the genus saccharomyces, saccharomycopsis and candida.** Grafl, H.J. (Giessen Univ. (Germany, F.R.). Fachbereich Biologie). 13 Apr 1982. 206p. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE84770087.

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The following results were obtained: Yeasts are not more sensitive to heavy metal than other microorganisms. The species-specific differences concerning sensitivity and accumulation are lower than with higher fungi. Zn may promote the velocity of growth, whereas Hg and Cd may reduce it, and Pb does not cause any effects. Small doses of Zn and Cd provoke antagonistic and with high dosages synergistic effects. Primarily the yield is not reduced. High concentration factors appear above all with Cd, the Hg accumulation by far doesn't achieve so high values as with the basidiomycetes. Protein content and composition of amino acids do not change significantly under the influence of heavy metals. Cell proliferation responds more sensitively to heavy metals then the other investigated parameters. In vitro enzyme tests cannot be attributed to in vivo conditions. In vivo Pb and Cd considerably stimulate the enzyme activity, which may even be increased by adding Zn or Hg. Interaction occurs principally between the elements of the second side-group.

12857 (NP—4770091) **Crop productivity and cadmium exposure due to contaminated food.** Isermann, K.; Siegel, O. (BASF A.G., Limburgerhof (Germany, F.R.). Landwirtschaftliche Versuchsstation). 1982. 25p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84770091.

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Any increase in the Cd content of the soil and thus in what grows on the soil is caused only by immissions or by using polluted composted municipal waste and sewage sludge or material dredged from rivers. These sources must be eliminated as far as possible. The plant availability of Cd is very dependent on the soil's pH and rH. In the case of polluted soils, care must be taken through liming that the pH does not drop below 6.5. The Cd uptake of plant species, and varieties may vary enormously. Plant nutritionists and breeders should therefore consider how varieties with a low affinity for Cd can be selected and possibly bred as well. The injury threshold for plants from Cd is substantially higher than it can ever be reached through fertilization with Cd-containing mineral fertilizer phosphates. The present cadmium content of human kidneys is about 8 to 16 μg, on an average about 12 μg, of Cd/g of renal cordex. It increases with age up to an age of 50 to 60 when it drops again. No accumulation has been detected in cerebral matter. The assertion that the cadmium pollution of the inhabitants of the Federal Republic of Germany is increasing cannot be upheld. As a whole, the results of the investigations mentioned here have shown that there are no grounds for panic since pollution of the population with Cd from food is relatively slight. No impairment to health resulting from cadmium from the environment has so far become known to us. This, however, must not allow us to lose sight of cadmium.

12858 (NP—4770157) **Analysis and assessment of potential hazards of selected volatile halogenated hydrocarbons in the human environment.** Lahl, U. (Bremen Univ. (Germany, F.R.). Fachbereich Naturwissenschaften). Mar 1983. 177p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE84770157.

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Sensitive, reliable analytical methods have been developed for the detection of highly volatile halogenated organic compounds (HOC) in water, food and air samples. Some preliminary conclusions may be drawn from the data presented here concerning the HOC-exposure of German citizens. Overall the following compounds dominate in order of concentration: tetrachloroethylene, trichloro-ethylene, 1,1,1,-trichloroethane, chloroform, and carbon tetrachloride. The average daily uptake of these compounds is 0.1 to 1 μg/kg body weight. Excessively high levels and especially hazardous exposures appear to be of particular importance since studies have revealed that the average load can be exceeded by an order of magnitude. After a careful weighing up of advantages and disadvantages cloar-cut reductions could be achieved in individual case and would be feasible. On the basis of an analysis of the toxicological relevance of the effects of HOC's a recommendation is made to minimize present or known hazards. An estimation of risk of possible long-term injury to German citizens through continuous daily uptake of μg amounts of HOC leads to unsatisfactory and unreliable results since the toxicological data presently available is incomplete.

12859 (PB—83-250274) **Some physical, chemical, toxicological, and physiological aspects of fire smokes.** Seader, J.D.; Einhorn, I.N. (Utah Univ., Salt Lake City (USA). Flammability Research Center). Jul 1976. 70p. NTIS, PC A04/MF A01.

This paper discusses the physics of smokes with some attention to the chemical nature and component concentrations of smokes. Progress in developing methodologies for the chemical analyses of smoke gases is reviewed, and a test protocol developed to determine the qualitative and quantitative nature of the intoxication syndrome resulting from smoke exposure is analyzed. It is shown that the most important variable in determining whether or not smoke will obscure light is particulate mass concentration. The particulate optical density is shown to be bounded by two relatively narrow ranges, one for aerosols and one for carbonaceous soots.

12860 **(PB—84-101575) Comparison of analytical techniques for occupational mortality studies with an empirical example. Doctoral thesis.** Amandus, H. (North Carolina Univ., Chapel Hill (USA)). 23 Jul 1982. 220p. NTIS, PC A10/MF A01.

Seven techniques for analyzing the mortality of an occupational cohort in a follow-up study were compared. These were the standardized mortality ratio calculated by the life table and modified life table methods, the logistic model used in the case-control mode, and five multiplicative proportional hazard survival models. The methods were compared empirically using data on 3,726 U.S. male Appalachian bituminous coal miners whose vital status were traced over a 14 year period from 1962 to 1975 and who were examined by the U.S. Public Health Service between 1963 and 1965. The disease outcome considered in the analyses was death from a non-malignant respiratory disease. Exposure to coal mine dust was defined by the number of years worked underground prior to the examination and the ILO radiographic category of the profusion of small opacities peculiar to coalworkers' pneumoconiosis. Risk factors for nonmalignant respiratory disease which were considered were cigarette smoking, age, exposure to other dusts, urban-rural area and geographic region of residence, and race. All risk factors and exposure data were obtained from the examination at the beginning of the 14 year period of follow-up.

12861 **(SFB—80/E/213) Biologically subjected mass transfer at the water bottom.** Backhaus, L. (Karlsruhe Univ. (T.H.) (Germany, F.R.). Sonderforschungsbereich Ausbreitungs- und Transportvorgaenge in Stroemungen). Feb 1982. 119p. (In German). Available from Fachinformationszentrum Energie, Physik, Mathematik, Karlsruhe (Germany, F.R.).

Independent on the oxygen concentration with the mineralization in the totally intermixed system a degradation of particular substance takes place up to 90%. The liberation of inorganic nutrients, such as phosphate and ammoniam, occurs under O_2 consumption to the same extent as the particular organic substance is reduced by these components and favours seaweed growth. Transition from aerobic to anaerobic bacterial metabolism is linked with a phosphate liberation independent on the mineralization of sludge. This mechanism seems to be responsible for immediate liberation of many sediments if the O_2 concentration decreases to zero at the water bottom. With preponderance of anaerobic metabolism an increase in concentration of solved organic compounds is observed which are deoxygenated with increasing aerobic character of mineralization under O_2 consumption. Without I_2 as in the transition region from anaerobic to aerobic conditions a total desulfurization occurs. Heavy metals as Zn inhibit the biological reactions and retard the mineralization process as recognized by the decreased velocity of phosphate and ammoniam liberation and of nitrification. Phosphate liberation is superposed very strongly by precipitation and solution mechanisms which depend on pH and increase their importance from pH 7. Diffusion is the determining transfer mechanism between sediment and water. Mineral sediment components influence mass transfer by their sorptive properties.

12862 (UCRL—52000-83-11, pp 9-19) **Detoxification of environmental copper in the common mussel.** Nov 1983. NTIS, PC A03/MF A01.

In Energy and technology review.

The mussel, Mytilus edulis, was studied to elucidate the biochemical mode of detoxification, especially as the tolerance of mussels to copper from polluted ecosystems is related. Investigations focused on two methods of detoxification: the binding of copper to metallothionein-like proteins and the incorporation of copper into lysosome-like vesicles. (PSB)

12863 **(UCRL—89891) Statistical analysis of high SCE frequency cells in human lymphocytes.** Moore, D.H. II; Carrano, A.V. (Lawrence Livermore National Lab., CA (USA)). Dec 1983. Contract W-7405-ENG-48. 24p. (CONF-831261—1). NTIS, PC A02/MF A01. Order Number DE84005433.

From International symposium on sister chromatic exchange; Upton, NY, USA (4 Dec 1983).

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The existence of a subpopulation of lymphocytes in which genetic damage persists was identified in experiments on rabbits injected with low levels of mitomycin C. This led to the suggestion that an important parameter to quantify after exposure to a possibly harmful agent may be the proportion of cells with high sister chromatid exchange (SCE) frequency, i.e., high frequency cells (HFCs). In the research reported here we describe the statistical properties of HFCs, particularly their utility in detecting low levels of genetic damage which may be undetected by a simple t-test comparing the means of two samples of SCEs.

12864 **Effects of ammonium sulfate aerosols on vegetation--II. Mode of entry and responses of vegetation.** Gmur, N.F. (Brookhaven National Lab., Upton, NY); Evans, L.S.; Cunningham, E.A. *Atmospheric Environment;* 17: No. 4, 715-721(1983). Contract AC02-76CH00016.

These experiments were designed to provide information on the rates of aerosol deposition, mode of entry, and effects of deposition of submicrometer ammonium sulfate aerosols on foliage of Phaseolus vulgaris L. A deposition velocity of 3.2×10^{-3} cm s^{-1} was constant during 3-week exposures of plants to aerosol concentrations of 26mg m^{-3} (i.e., about two orders of magnitude above ambient episode concentrations). Mean deposition rate on foliage was 4.1×10^{-11} μg cm^{-2} s^{-1}. Visible injury symptoms included leaf chlorosis, necrosis, and loss of turgor. Chlorosis was most frequent near leaf margins causing epinasty and near major veins. Internal injury occurred initially in spongy mesophyll cells. Eventually abaxial epidermal and palisade parenchyma cells were injured. These results suggest that submicrometer aerosols enter abaxial stomata and affect more internal cells before affecting leaf surface cells. Exposure to aerosols decreased both abaxial and adaxial leaf resistances markedly. Although visible injury to foliage occurred, no change in dry mass of roots and shoots or leaf area occurred. These results suggest that for the plant developmental stage studied, while leaf resistances decreased and cellular injury occurred in foliage, these factors were not significantly related to plant growth and development.

12865 **Induction of mammary tumors in virgin female BALB/c mice by single low doses of 7,12-dimethylbenz[a]anthracene.** Ethier, S.P. (Univ. of Tennessee, Oak Ridge); Ullrich, R.L. *Journal of the National Cancer Institute;* 69: No. 5, 1199-1203(Nov 1982). Contract W-7405-ENG-26.

The induction of mammary tumors in virgin female inbred BALB/c mice after administration of 7,12-dimethylbenz[a]anthracene (DMBA) over a wide range of doses was studied. Mice were exposed at 12 weeks of age to single or multiple doses of DMBA ranging from 0.0025 to 12.0 mg by gastric intubation and were checked regularly for mammary tumors. The experiment was terminated when the mice were 800 days of age. In the dose range of 0.0025-0.125 mg DMBA, the incidence of mammary tumors was dose-dependent. At higher doses, the mammary tumor incidence became less dose-dependent and was nearly independent of doses above the 0.25-mg level. Analysis of the data for the rate of appearance of mammary tumor with age of the animals and for the age at death of non-mammary tumor-bearing animals indicated that in the low dose range induction of mammary tumors was the predominant effect of DMBA exposure, whereas at moderate to high doses the toxic and carcinogenic effects of DMBA on other tissues significantly influenced the final incidence of mammary tumors. Greater than 90% of the tumors that resulted from administration of low doses of DMBA were adenocarcinomas. In contrast, adenocarcinomas and adenoacanthomas were found in approximately equal proportions following administration of high doses of DMBA.

12866 **Effects of adamantane derivatives on the stability and assembly of bacteriophage PM2.** Choo, S.Y.; Vollherbst, K.; Keith, A.; Snipes, W. (Pennsylvania State Univ., University Park). *Canadian Journal of Microbiology;* **28**: No. 7, 897-900(1982).

1-Adamantanamine and several related compounds were tested for their effect on the lipid-containing bacteriophage PM2. 2-Adamantanol and 1-adamantane methanol were virucidal, while 1-adamantane acetic acid inhibited virus production in a highly pH-dependent manner.

5604 Other Environmental Pollutant Effects

12867 **(DOE/BP—181) Environmental studies for a 1100-kV power line in Oregon. A special report.** Rogers, L.; Hinds, R. (Battelle Pacific Northwest Labs., Richland, WA (USA)). 1983. Contract AC06-76RL01830. 33p. NTIS, PC A03/MF A01. Order Number DE84004625.

In the first research project to monitor the effects of 1100-kV transmission on a natural ecosystem, researchers at Battelle, Pacific Northwest Laboratories have studied responses of wildlife, native plants, honeybees, and agricultural crops and cattle. No adverse effects were detected on wildlife, crops or cattle. Effects were observed on trees growing within the defined right of way and on honeybee colonies placed beneath the line.

58 GEOSCIENCES

5801 Geology And Hydrology

REFER ALSO TO CITATION(S) 11585, 11590, 11605, 11615, 11647, 11648, 11649, 11650, 11810, 12735

12868 **(UCID—19785-84) Stratigraphic contacts for drill holes at the Nevada Test Site.** Howard, N.W.; Bell, C.A. (Lawrence Livermore National Lab., CA (USA)). Jan 1984. Contract W-7405-ENG-48. 46p. NTIS, PC A03/MF A01. Order Number DE84006224.

This report lists all holes which have been drilled at the Nevada Test Site for which stratigraphic contacts have been measured or estimated, and entered into the LLNL Containment Program Test Effects and Geological Data Bank. No post shot holes and not many instrument holes are listed, because there is not much geologic information for them. Water wells and hydrologic test holes usually do have data, and all are listed. A list of the parameters is included.

5802 Geophysics

REFER ALSO TO CITATION(S) 11608

12869 **(NUREG/CR—3143-Vol.3) Indirect rock mass investigations for optimizing borehole drilling programs. Volume 3. Ray optic geotomography.** Doerr, T.A.; Glass, C.E.; Dudley, D.G.; Lyon, C.C. (Arizona Univ., Tucson (USA). Dept. of Mining and Geological Engineering). Oct 1983. 159p. NTIS, PC A08/MF A01 - GPO $5.50. Order Number DE84900703.

Waves, by way of their speed of propagation, interaction with boundaries, and energy loss mechanisms, yield information related to the physical properties of media, through which they pass. Measurements of wave characteristics at the ground surface or in boreholes, therefore, provide a means by which to ascertain the geologic properties and internal geometry of a rock mass. The resolution of wave propagation techniques is shown to be theoretically limitless, depending only on instrument sensitivity and noise. Because of this, we recommend using techniques that can be applied in immediate proximity to candidate rock masses. Geotomography and wavefront reconstruction (holography) are considered two promising techniques for site investigation and characterization. Of the two, geotomography is treated in detail because of its lower sensitivity to noise, and ease of implementation. Algorithms are presented for both ray-optic geotomography and diffusion geotomography. Although the diffusion geotomography algorithm is more general and more satisfying from a physics standpoint, for large numbers of measurements (typical field situations) the mathematics of the inverse problem implicitly requires source frequencies that approach ray optic behavior. The ultimate conclusion is that, regardless of the algorithm used, one should probe using the highest source frequencies possible for given site conditions.

12870 **(NUREG/CR—3143-Vol.4) Indirect rock mass investigations for optimizing borehole drilling programs. Volume 4. Wave diffusion geotomography.** Howard, A.Q. Jr.; Glass, C.E.; Henry, D.B.; N'Guessan, D.M.; Siemers, D.M. (Arizona Univ., Tucson (USA). Dept. of Mining and Geological Engineering). Oct 1983. 122p. NTIS, PC A06/MF A01 - GPO $5.00. Order Number DE84900700.

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Waves, by way of their speed of propagation, interaction with boundaries, and energy loss mechanisms, yield information related to the physical properties of media, through which they pass. Measurements of wave characteristics at the ground surface or in boreholes, therefore, provide a means by which to ascertain the geologic properties and internal geometry of a rock mass. The resolution of wave propagation techniques is shown to be theoretically limitless, depending only on instrument sensitivity and noise. Because of this, we recommend using techniques that can be applied in immediate proximity to candidate rock masses. Geotomography ad wavefront reconstruction (holography) are considered two promising techniques for site investigation and characterization. Of the two, geotomography is treated in detail because of its lower sensitivity to noise, and ease of implementation. Algorithms are presented for both ray-optic geotomography and diffusion geotomography. Although the diffusion geotomography algorithms is more general and more satisfying from a physics standpoint, for large numbers of measurements (typical field situations) the mathematics of the inverse problem implicitly requires source frequencies that approach ray optic behavior. The ultimate conclusion is that, regardless of the algorithm used, one should probe using the highest source frequencies possible for given site conditions.

12871 **(NUREG/CR—3555) Lateral variations in attenuation of ground motion in the Eastern United States based on propagation of L/sub g/.** Gupta, I.N.; Burnetti, J.A.; McElfresh, T.W.; von Seggern, D.H.; Wagner, R.A. (Teledyne Geotech, Alexandria, VA (USA)). Nov 1983. 96p. NTIS, PC A05/MF A01 - GPO $4.75. Order Number DE84900720.

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Lateral variations in the attenuation characteristics of ground motion in the Eastern United States (EUS) are determined by studying the propagation of the L/sub g/ phase. This is achieved by detailed investigations of nearly all available short-period three-component data from a large number of LRSM seismograph stations. Both time and frequency-domain methods of analyses are employed to data from numerous earthquakes and the well instrumented underground nuclear explosion, SALMON. Maps of station terms for the vertical and horizontal components of L/sub g/, obtained in this study, may be used to estimate the largest amplitudes of the vertical or horizontal component of L/sub g/ in various parts of the EUS. In general, sites within the central stable region have the largest whereas those in the coastal plains region have the smallest values of station terms. Large station terms in the central stable region suggest significantly lower attenuation, probably due to the relative lack of tectonic activity in this region. The ratio of the largest horizontal to the largest vertical component of L/sub g/ shows unexpectedly large regional variations that are important since most damage is generally caused by the horizontal components of ground motion. 53 references, 28 figures, 7 tables.

5803 Mineralogy, Petrology, And Rock Mechanics

REFER ALSO TO CITATION(S) 11578, 11605, 11624, 12869, 12870

12872 **(SAND—83-1223) Model for the deformation of porous materials.** Butcher, B.M. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1983. Contract AC04-76DP00789. 32p. NTIS, PC A03/MF A01. Order Number DE84005863.

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Materials with intentionally induced porosity are used for energy absorption and shock mitigation. A new method for describing the shear compaction of porous rocks has been developed which is an extension of a model of solid rock deformation proposed by Rudnicki and Rice. This isotropic theory requires specification of a damage surface function, which depends on the state of compaction, a dilatancy factor, which defines the extent of compaction associated with shearing the rock, and appropriate (nonlinear) elastic constants. Parameters for the damage and the elastic constant functions are related to the p - α model, widely used to describe dynamic compaction. In addition to theoretical development of the model, an example of how to construct material parameters for description of a low porosity saturated tuff was developed to illustrate its application.

5804 Geochemistry

REFER ALSO TO CITATION(S) 11578, 11625, 12140, 12430

12873 **(SKBF-KBS-TR—82-20) Fissure fillings from Finnsjoen and Studsvik Sweden. Identification, chemistry and dating.** Tullborg, E.-L.; Larsson, S.Aa. (Svensk Kaernbraenslefoersoerjning AB, Stockholm). Dec 1982. 78p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE83704362.

Samples were taken from cores and collected at different levels. The bedrock at Finnsjoen is a Svecokarelian granite-granodiorite, the most frequent mineral in the fissures being calcite. The water from boreholes have a mean $S^{18}O$ value of -12 per thousand and saturated by calcite. Isotopically three different groups of calcite have been distinguished. Ages of 29+-13x10^3 years to 79+-25x10^3 years were estimated. Two generations of quartz were recognized, the minerals prehnite and lanmontite were found. Most fissure filling materials have cation exchange capacities. The bedrock at Studsvik is a Svecokarelian gneiss of sedimentary type which is migmatized with calcite and chlorite as fissure filling minerals. Most fissure fillings are thin and simple Claby minerals of smectite type are also frequent.

5805 Oceanography

REFER ALSO TO CITATION(S) 12525, 12736

64 PHYSICS. I.

12874 **(SUNI—76) Annual research report for the year ending December 1982.** McMurray, W.R.; Renan, M.J. (eds.). (Southern Universities Nuclear Inst., Faure (South Africa)). 1983. 100p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE83704376.

In this report progress for the year ending December 1982 is reported on the following: the 5.5MV Van De Graaff accelerator; nuclear reactions, nuclear structure and techniques; nuclear analytical chemistry; atomic physics; solid state and materials research; medical and life science; industrial and environmental projects; data acquisition and processing and the Nuclear Development Corporation (NUCOR) Isotope Unit. A bibliography is also given on research publications and reports.

6401 Astrophysics And Cosmology

REFER ALSO TO CITATION(S) 12674

12875 **(FRNC-TH—1166) Contribution to the study of the impulsive and gradual phases of solar flares.** Vilmer, N. (Paris-7 Univ., 75 (France)). Jun 1981. 178p. (In French). NTIS (US Sales Only), PC A09/MF A01. Order Number DE84750417.

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Particular points concerning electrons emitted during solar flares are studied, given the recent hard X radiation observations (ISEE 3) obtained, for the first time, with a good time resolution (0,5s), on a large spectral zone, together with the radioelectric observations having also a good time resolution. In a first chapter, essential points of the earlier X rays observations, and relations between radioelectric and X emission are presented. Problems raised by these observations are underlined. The different X radiation models generally available in the literature are examined. Interpretation, in these models, of some observed properties of hard X radiation is proposed. Two short chapters are reserved to the characteristics of X and radioelectric data used. Electron injection characteritics is then deduced from periodicity study of some events; a relation between hard X emission and continuous radioectric radiation for different wavelengths, on a large height scale in the corona, is established. An interpretation model of hard X radiation is presented. At least, a new approach (from radio bursts), to the electron beam study in the corona, is discussed, in particular their injection and their propagation.

12876 **(FRNC-TH—1386) Chromospheric manifestations in solar hydrodynamics.** Foing, B. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France); Paris-7 Univ., 75 (France)). Feb 1983. 206p. (In French). NTIS (US Sales Only), PC A10/MF A01. Order Number DE84750463.

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Monochromatic pictures of the sun have been obtained during the second flight of the Transition Region Camera, in the ultra-violet continuum. 160 nm intensity distribution has been studied statistically. The trace of solar structures are underlined, at the temperature minimum, by the statistical distribution of the brightness quanta parameters. The ladder series and their spatial organization have been studied. Physical origin of the brightness quanta, in solar atmosphere seem to be explained, for the chromospheric network, as magnetic element flux tubes effects on the energy and radiation balance at small scale, but also by trace of energy propagation and non radiative heating in the quiet chrom^{9}uosphere.

12877 **(PB—83-253443) Solar-geophysical data number 466, June 1983. Part 2 (comprehensive reports). data for December 1982.** Coffey, H.E. (National Geophysical Data Center, Boulder, CO (USA)). Feb 1983. 93p. NTIS, PC A05/MF A01.

Topics covered include the following: Solar radio emission; Solar x-ray radiation; Mass ejections from the sun.

12878 **(SLAC-PUB—3250) Fragmentation of quarks and gluons, tests of QCD in e^+e^- annihilation.** Dorfan, J. (Stanford Linear Accelerator Center, CA (USA)). Oct 1983. Contract AC03-76SF00515. 28p. (CONF-8308101—9). NTIS, PC A03/MF A01. Order Number DE84005327.

From International symposium on lepton and photon interactions at high energies; Ithaca, NY, USA (4 Sep 1983).

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This report covers the topics of fragmentation of quarks and gluons and tests of QCD in e^+e^- annihilation and is a summary of a rapporteur talk given at the 1983 International Symposium on Lepton and Photon Interactions at High Energies. New data on the general characteristics of the e^+e^- environment at the Y and at PETRA and PEP are discussed. For the first time there is a lot of data on resonance production - eta, K*, rho, phi, Ξ. There is more data on c quark fragmentation from tagged D/sup *+-/ and direct observation of D^+ and D^0. There are four experiments using high

P/sub t/ leptons to measure the b quark fragmentation function - agreement amongst the experiments is very good. All these measurements can usefully be incorporated in the Monte Carlo simulation models. QCD tests are discussed. α_s has been measured using the energy dependence of the total hadronic cross section. Unfortunately this method is not very precise. Other measurements of α_s from shape analyses and energy-energy correlations have been done including the effects of all second order QCD diagrams. The results seem to depend both on the procedure and the models used to extract α_s. The evidence for differences in gluon and quark fragmentation are reviewed. There is now evidence that baryon conservation occurs locally in a jet rather than globally in an event. Multiplicity and jet mass correlations are presented as well as data on KNO scaling. 46 references.

12879 **Simplified equation of state near nuclear density.** Bethe, H.A. (California Inst. of Tech., Pasadena (USA). W.K. Kellogg Radiation Lab.); Brown, G.E.; Cooperstein, J. (State Univ. of New York, Stony Brook (USA). Dept. of Physics); Wilson, J.R. (California Univ., Livermore (USA). Lawrence Livermore National Lab.). *Nuclear Physics [Section] A;* **403**: No. 3, 625-648(25 Jul 1983).

The equation of state near nuclear density influences shock formation in stellar collapse supernovae. The drop in the adiabatic index below 4/3 in this region, due to the negative nuclear pressure, disturbs the homology of the inner core and decreases its size. The initial shock energy and formation dynamics are particularly sensitive to matter in this regime. Only matter at low entropies (S <= 1.5) in the unshocked inner core approaches nuclear densities. We derive a simple equation of state for this material and find that nuclear properties are close to those at S = 0. The entropy associated with the nuclear surface can be absorbed into an 'effective mass' which decreases towards one with increasing density, giving an accurate accounting for the storage of entropy in the excitation of the large nuclei. Such thermal excitation drains energy with little contribution to the pressure and thus may have important effects on the launching of the shock. Two phase transitions are considered. The first, from the heavy nucleus to the 'bubble' phase, occurs at half nuclear matter density and is accomplished by use of simple expressions for the energy and pressure that include effects of the transition implicitly. The second, that to uniform nuclear matter, is done by requiring continuity of the pressure and entropy at the transition. The density at which this transition takes place is calculated and is found to decrease with entropy in a simple manner. With the use of suitable approximations, the equation of state is presented in a non-iterative form easily adapted for use in full hydrodynamical calculations of the supernovae process. Comparison with more detailed equations of state is made and the simplified one is found to represent well all important features.

6402 Atmospheric Physics

12880 **(AD-A—130933/5) Results of places data analysis. Technical report.** Prettie, C.W. (Berkeley Research Associates, Inc., CA (USA)). 1 Sep 1982. 88p. NTIS, PC A05/MF A01.

The results of analyses performed to support PLACES data reduction and data interpretation are presented. Beacon receiver measurements of the scattering of a 100 MHz pseudo-noise beacon signal BPSK modulated at a 10 MHz rate were made during an occultatation by the structured IRIS ion cloud. The scattering produced features in the received St. George Island signal that are shown to be in good quantitative agreement with propagation effect predictions produced from an optically derived model of the ion cloud extent. The features in the received data are also in qualitative agreement with the optical features in a coincident St. George Island photograph. Neutral wind shear rate is determined in the optical analyses to be directed with a 351 deg azimuth with a 1.5 meter per second per kilometer of altitude magnitude. Aircraft propagation measurements of the JAN ion cloud reveal a steady decay of the TEC until the cloud effects vanish at roughly 200 minutes after release. The following mechanism is proposed to explain late time barium cloud decay: Barium ions are removed from the ion cloud as current carriers and are replaced by molecular air ions which quickly recombine. The mechanism is found to be highly efficient. The kHz frequency spurs in the NRL density probe data from JAN are briefly investigated. The spur frequency is found to have no clear-cut dependence on local density, is not confined to the ion cloud region, and at times two spurs are visible in the data.

12881 **(AD-A—131868/2) Model for chorus associated electrostatic bursts. Progress report.** Grabbe, C.L. (Iowa Univ., Iowa City (USA). Dept. of Physics and Astronomy). 30 Jun 1983. 31p. NTIS, PC A03/MF A01.

The linear theory of the generation of electrostatic bursts of noise by electrons trapped in chorus wave packets is developed for a finite temperature electron beam and a Maxwellian electron and ion background. The growth rates determined qualitatively in good agreement with those obtained by previous authors from a more idealized model. Two connected instability mechanisms seem to be occurring: a beam plasma (electron-ion two-stream) instability commonly associated with intensification of the chorus power levels, and a transitional or borderline resistive medium instability commonly associated with chorus hooks. The physical reasons for the two mechanisms is discussed. In the second case electron beams are difficult to identify in the particle data. An expression is obtained for the maximum growth rate in terms of the ratios of the beam and electron thermal velocities to the beam velocity, and of the beam density to plasma density. It is anticipated that this may allow the observed peak in the electrostatic noise spectrum to be used as a diagnostic for the beam characteristics.

12882 **(TRITA-EPP—82-02) Rocket and ground-based study of an auroral breakup event.** Marklund, G.; Baumjohann, W.; Sandahl, I. (Royal Inst. of Tech., Stockholm (Sweden). Electron and Plasma Physics). Feb 1982. 35p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83703868.

On 27 January, 1979 the substorm-GEOS rocket S23H was launched from ESRANGE, Kiruna, shortly after the onset of an intense magnetospheric substorm over northern Scandinavia. Rocket electric field and particle observations have been used to calculate ionospheric currents and heating rates. These results are generally consistent with the ground magnetic and optical observations. An important finding emerging from a comparison of this event with a pre-breakup event earlier on this day is that the ionospheric substorm-related electric field could be split up into two parts, namely: 1) an ambient LT dependent field, probably of magnetospheric origin 2) superimposed on this a small-scale electric field associated with the bright auroral structures, being southward for both events. This is shown to have important consequences on the location of the ionospheric currents and the Joule energy discussion relative to the auroral forms.

6403 Atomic, Molecular, And Chemical Physics

REFER ALSO TO CITATION(S) 12614

12883 **(AD-A—133102/4) Rotational energy transfer in highly vibrationally excited hydrogen fluoride and deuterium fluoride. Summary report Jun 82-May 83.** Crim, F.F. (Wisconsin Univ., Madison (USA). Dept. of Chemistry). 16 Mar 1983. 7p. NTIS, PC A02/MF A01.

Overtone vibration-laser double resonance measurements have provided new data on vibrational and rotational relaxation in HF(v = 2). These experiments determine the magnitudes of the total vibrational relaxation rate constants for HF(v = 1 and 2) as well as their temperature dependences. Rotational relaxation data come from these measurements as well. The temporal evolution of individual rotational states observed in the double resonance studies provides level-to-level energy transfer rate constants when analyzed using an iterative fitting scheme which incorporates scaling relations among the rate constants.

12884 **(AD-A—133942/3) Collisional energy exchange in polyatomic molecules. Final technical report, 1 January 1980-31 December 1982.** Ryali, S.B.; Fenn, J.B. (Yale Univ., New Haven, CT (USA). Dept. of Chemical Engineering). 21 Aug 1983. 15p. NTIS, PC A02/MF A01.

Fourier Transform Infrared Spectrometry (FTIS) has been used to study several kinds of gas-gas and gas-surface collision processes brought about with and in supersonic free jets in vacuo. Following are some key results: (1) Terminal distributions of rotational energy in free jets of CO and CO2 show a non-Boltzmann distribution that can be characterized by a two-temperature model and explained in terms of competition between rotation-rotation and rotation-translation transfers. (2) Spectra of CO2 molecules excited by collisions with N2 molecules indicated similar two-temperature distributions, possibly due to secondary collisions between excited CO2 and N2. (3) The accommodations of vibrational and rotational energy during collisions between CO, CO2 and NO molecules and hot platinum surfaces has been determined over a range of surface temperatures. (4) Excess internal energies have been determined in nascent CO and CO2 molecules formed respectively by catalytic oxidation of C and CO on a platinum surface. An energy balance indicates that about 1/3 of the available reaction energy is absorbed by the surface, the remainder going mostly into vibrational modes of product molecules.

12885 **(AD-A—134093/4) Collisional excitation and radiation of atoms and molecules. Final technical report, 1 July 1978-30 June 1983.** Lin, C.C. (Wisconsin Univ., Madison (USA). Dept. of Physics). 19 Aug 1983. 5p. NTIS, PC A02/MF A01.

The general objectives of this research project are to study collisional excitation of atoms and molecules and the radiation emitted by these excited atoms and molecules. Our major efforts include electron excitation of the sodium and xenon atoms, excitation of electronic states of nitrogen molecules, formation of excited nitrogen atoms by electron-impact dissociation of nitrogen molecules, Measurement of electron excitation cross sections of metastable levels of neon atoms, excitation of atoms by H+, H0, H- impact.

12886 **(CPAT-RA—1982) 1982 Progress report.** (Toulouse-3 Univ., 31 (France). Centre de Physique Atomique). 1983. 162p. (In French). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84750482.

Portions are illegible in microfiche products.

In this report, a separate item is formed for each research group by the searchers list, the articles, thesis and congress communications list, together with brief abstract. The research subjects are oriented in four principal directions: discharges in gases, atom collisions, radiological physics, aerosols and atmospheric exchanges physics. Post luminescence in gases, discharges in weak current gases, electric arcs, chemistry in plasmas are gathered in the first item, while the third item is concerned with experimental dosimetry radiation transport in matter and theoretical dosimetry.

12887 **(DOE/ER/02718—11) Low energy ion-neutral collisions. Progress report, June 1, 1983-May 31, 1984.** Leventhal, J.J. (Missouri Univ., St. Louis (USA)). Jan 1984. Contract AC02-76ER02718. 11p. (COO—2718-11). NTIS, PC A02/MF A01. Order Number DE84005392.

Work performed during the past year is described. Ion production in vapor irradiated by a pulsed laser was investigated. The production mechanisms were found to be considerably different from those that take place in vapor that is irradiated by cw laser light. In a separate set of experiments collisional excitation was examined; it was found that this process obeys the same selection rules as optical excitation, thus confirming theory.

12888 **(DOE/ER/06036—T2) X-ray emission in heavy ion collisions. Progress report, April 1, 1983-December 31, 1983.** Watson, R.L. (Texas A and M Univ., College Station (USA). Cyclotron Inst.). Dec 1983. Contract AS05-78ER06036. 41p. NTIS, PC A03/MF A01. Order Number DE84005178.

The report covers recently completed work in electron transfer to n $\geqq$ 3 states of fluorine following K-plus L-shell ionization by heavy ions; K x-ray spectra of solid and gaseous fluorine compounds excited by 2 MeV/amu Ar and Mg ions; semiemperical scaling law for np - ls transition intensity ratios of multiply ionized atoms. Work in progress is also reported for studies of electron transfer to n $\geqq$ 3 states of fluorine following heavy-ion impact; alignment of P-states in 48 MeV foil-excited Mg ions; measurement of the reflectivity of an ADP Crystal; velocity dependence of dynamic screening x-ray energy shifts; and systematics of Kα satellite structure in spectra of gases and solids excited by 80 MeV Ar ions. (GHT)

12889 **(LBL—16753) Quantum Monte Carlo for molecules.** Reynolds, P.J.; Lester, W.A. Jr. (Lawrence Berkeley Lab., CA (USA)). May 1983. Contract AC03-76SF00098. 23p. (CONF-830589—3). NTIS, PC A02/MF A01. Order Number DE84005171.

From 10. National Organization for the Professional Advancement of Black Chemists and Chemical Engineers (NOBCCHE) annual meeting; Knoxville, TN, USA (25 May 1983).

An alternative approach to conventional quantum chemistry techniques for molecular studies is described. This approach uses the quantum Monte Carlo method, which was developed and used primarily in nuclear and condensed-matter physics. In this approach the many-body Schroedinger equation is re-interpreted as a diffusion equation. Simulation of the appropriate random walk process allows one to calculate expectation values of molecular properties. In principle these expectation values can be calculated exactly, subject only to statistical errors (which may be made arbitrarily small). In preliminary work on small molecules (H_2, LiH, Li_2, and H_2O), we use a simple but accurate approximation to ease the treatment of Fermi statistics. In that approximation, the calculated total energy remains an upper bound to the true energy. How good the bound is, as well as the magnitude of the statistical error, depends on the quality of an importance function which guides the diffusion into more probable regions of phase space. With relatively simple importance functions, we obtain from 75 to 100% of the correlation energy of the above-mentioned molecules.

12890 **(LBL—17131) Specific heat of ^{3}He in the FERMI liquid region.** Mayberry, M.C. (Lawrence Berkeley Lab., CA (USA)). Dec 1983. Contract AC03-76SF00098. 101p. NTIS, PC A. Order Number DE84005713.

Paper copy only, copy does not permit microfiche production; Thesis.

The powdered cerium magnesium nitrate (CMN) temperature scale was used in measurements of the specific heat of ^{3}He at zero pressure between 6.5 and 190 mK. The new results are in good agreement with recent measurements made at Bell Laboratories, particularly if the Bell Laboratories results are recalculated on the original Bell Laboratories scale.

12891 **Method and apparatus for the production of cluster ions.** Friedman, L.; Beuhler, R.J. US Patent Application 6-452,362. [nd]. 22p. Contract AC02-76CH00016.

A method and apparatus for the production of cluster ions, and preferably isotopic hydrogen cluster ions is disclosed. A gas, preferably comprising a carrier gas and a substrate gas, is cooled to about its boiling point and expanded through a supersonic nozzle into a region maintained at a low pressure. Means are provided for the generation of a plasma in the gas before or just as it enters the nozzle.

12892 **(CEA-CONF—6817) Some theoretical results of approximation on the steady-state compressible Navier-Stokes equation.** Forestier, A.; Montagne, J.L. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). May 1983. 2p. (In French). (CONF-8305157—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750440.

From 16. colloquium of numerical analysis; Guidel, France (24 May 1983).

Published in summary form only.

6451 Particle Interactions And Properties - Experimental

REFER ALSO TO CITATION(S) 12651, 12652, 12658, 12916

12893 (CERN—83-02(Vol.2), pp 121-127) **sup(ν)tau production.** Myatt, G. (Oxford Univ. (UK). Nuclear Physics Lab.). 10 Feb 1983. NTIS (US Sales Only), PC A23/MF A01. (CONF-821256—Vol.2).

From Workshop on SPS fixed-target physics in the years 1984-1989; Geneva, Switzerland (6 Dec 1982).

The possibilities for the production of beams of νsub(tau) and the detection of their interactions are reviewed.

12894 (CERN—83-02(Vol.2), pp 113-120) **Hadronic final states in ν and anti ν experiments.** Tenner, A.G. (Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands)). 10 Feb 1983. NTIS (US Sales Only), PC A23/MF A01. (CONF-821256—Vol.2).

From Workshop on SPS fixed-target physics in the years 1984-1989; Geneva, Switzerland (6 Dec 1982).

An overview is presented of the experimental possibilities of the study of fragmentation in the BEBC bubble chamber, exposed to neutrino and antineutrino beams. Comparisons are made with other techniques: muon-hadron and electron-positron experiments. Possible improvements of BEBC are discussed that will improve our knowledge of the fragmentation.

12895 (CERN—83-02(Vol.2), pp 146-160) **Future possibilities for measurements of semileptonic neutral-current processes at the SPS.** Panman, J. (European Organization for Nuclear Research, Geneva (Switzerland)). 10 Feb 1983. NTIS (US Sales Only), PC A23/MF A01. (CONF-821256—Vol.2).

From Workshop on SPS fixed-target physics in the years 1984-1989; Geneva, Switzerland (6 Dec 1982).

Some possibilities for improvements of measurements of semileptonic neutral-current interactions of neutrinos on nuclei are discussed in the context of the SPS fixed-target programme.

12896 **(DOE/ER/01195—489) Forward charge distributions associated with hadronically produced J/psi particles.** Budd, H.S. (Illinois Univ., Urbana (USA). Dept. of Physics). 1983. Contract AC02-76ER01195. 173p. (COO—1195-489). NTIS, PC A08/MF A01. Order Number DE84005484.

Thesis.

We have measured the forward charge as a function of x/sub F/ of the psi for events produced by 225 Gev/c π-Be interactions. The forward charge is the average difference between the number of positive hadrons and negative hadrons produced in the forward hemisphere. The standard Drell-Yan model predicts that the forward charge should become less negative as the x/sub F/ of the J/psi increases. The measured forward charge becomes more negative as the x/sub F/ of the J/psi increases although it is consistent with being flat as a function of x/sub F/. Hence the data is not consistent with any Drell-Yan type model which assumes the forward charge is not strongly dependent on the hadronic energy left over after the J/psi is formed. 45 references.

12897 **(DOE/ER/01195—490) Production of charmonium states in 225 GeV/c pi-minus beryllium interactions.** Hahn, S.R. (Illinois Univ., Urbana (USA). Dept. of Physics). 1983. Contract AC02-76ER01195. 237p. (COO—1195-490). NTIS, PC A11/MF A01. Order Number DE84005492.

Portions are illegible in microfiche products; Thesis.

This thesis reports on the analysis of data obtained during the FNAL experiment E610. The Chicago Cyclotron Magnet Spectrometer was used to perform a study of the hadronic production of charmonium. A 225 GeV/c negative pion beam was incident on a beryllium target. The trigger required a dimuon signature which favored opposite sign muon pairs with a large combined p/sub tau/. A search was then made for chi mesons of the charmonium spectrum by combining J/psi mesons found in the dimuon spectrum with photons detected in a large lead glass shower detector. These events were used to determine the fraction of J/psis produced from chis. A psi(3685) signal seen in the dimuon spectrum was used to determine the fraction of J/psis resulting from psi(3685). Assuming that these are the only particles decaying to J/psi, we obtain the fraction of J/psis produced directly in hadronic collisions - 0.58 +- 0.09 - which is relevant to the production mechanism for charmonium in strong interactions.

12898 **(DOE/ER/01195—T4) Production of charmonium states in 225 GeV/c π-minus beryllium interactions.** Hahn, S.R. (Illinois Univ., Urbana (USA). Dept. of Physics). 1983. Contract AC02-76ER01195. 237p. NTIS, PC A11/MF A01. Order Number DE84005489.

Portions are illegible in microfiche products; Thesis.

This thesis reports on the analysis of data obtained during FNAL experiment E610. The Chicago Cyclotron Magnet Spectrometer was used to perform a study of the hadronic production of charmonium. A 225 GeV/c negative pion beam was incident on a beryllium target. The trigger required a dimuon signature which favored opposite sign muon pairs with a large combined p/sub tau/. A search was then made for chi mesons of the charmonium spectrum by combining J/psi mesons found in the dimuon spectrum with photons detected in a large lead glass shower detector. These events were used to determine the fraction of J/psi s produced from chi s. A psi(3685) signal seen in the dimuon spectrum was used to determine the fraction of J/psi s resulting from psi(3685). Assuming that these are the only particles decaying to J/psi, we obtain the fraction of J/psi s produced directly in hadronic collisions - 0.58 +- 0.09 - which is relevant to the production mechanism for charmonium in strong interactions.

12899 **(EFI—518(5)-82) Processing the experimental information on π0-meson photoproduction reactions.** Avakyan, R.O.; Garibyan, Yu.A.; Skhtoryan, E.M. (Erevanskij Fizicheskij Inst. (USSR)). 1982. 16p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704368.

A set of programs for processing the experimental information on the investigation of asymmetry in reactions of π-meson photoproduction with polarized photons is decribed. The problems of the identification of strainght tracks, of the particle energy determination by the stopping point in the range spectrometer and the sonstruction of kinematic picture of each event are considered. The programs are written in FORTRAN and AVTOCODE.

12900 **(KFK—3569) Analysis of hadronic events in high energetic e^+-e^- annihilations measured with the detector CELLO.** Randoll, H. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Kern- und Teilchenphysik). Jul 1983. 110p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84750079.

This work describes experimental results of electron positron annihilation into hadronic final states produced at energies of 22 GeV and 34 GeV in the storage ring PETRA at the "Deutsches Elektronensynchrotron" in Hamburg. The data were recorded by the detector CELLO. The events are analysed using a cluster method. They show a distinct structure of two collinear jets as expected by the Quark-Parton model. Within this model the two-jet events are interpreted as the generation of quark antiquark pairs with subsequent fragmentation into hadrons. Already at 22 GeV, clearer however at 34 GeV part of the data has the structure of three planar jets. The analysis of these data shows excellent agreement with the theory of quantum chromodynamics. This theory predicts the observation of three jet events caused by hard gluon emission.

12901 **(LAL—83-10) Results on point-like interactions of high energy photons.** Wormser, G. (Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire). Mar 1983. 25p. (CONF-830140—9). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750429.

From 18. Rencontre de Moriond conference; La Plagne, France (23 Jan 1983).

Inclusive π^0 and γ photoproduction results are presented. VDM alone cannot explain the π^0 data which are found to be compatible with first order QCD predictions. A clear prompt γ signal is

found in the whole studied kinematical range. This signal is in agreement at high Psub(T) or high Psub(L) with QED prediction. This agreement is supported by a preliminary exclusive analysis.

12902 **(LAL—83-12) Study of the $e^+e^- \rightarrow \pi^+\pi^-\pi^0$ and $e^+e \rightarrow \pi^+\pi^-$ eta reactions between 1.4 and 1.9 GeV.** Ayach, L. (Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire; Paris-11 Univ., 91 - Orsay (France)). Jun 1983. 139p. (In French). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84750421.

The $\pi^+\pi^-\pi^0$ and $\pi^+\pi^-$ eta cross sections have been studied between 1.4 and 1.9 GeV from data obtained in the DM2 experiment, corresponding to a luminosity of 489 nb^{-1}. 179 events have been selected in the $\pi^+\pi^-\pi^0$ mode, with a 8% background. Apparently, dynamics favors a rhoπ production. For the $\pi^+\pi^-$ eta mode (95 selected events), our result is in agreement with the DM1 experiment. The behavior for the $\pi^+\pi^-\pi^0$ cross section is compatible with the existence of an ω', fully degenerated in mass and width with the rho'.

12903 **(LAL—83-21) Study of e^+e^- annihilation in the 1400-2250 MeV energy range with the magnetic detector DM2 at DCI.** Augustin, J.E.; Ayach, L.; Calcaterra, S. (Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire). Jul 1983. 32p. (CONF-830718—15). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84750466.

From International Europhysics conference on high energy physics; Brighton, UK (20 Jul 1983).

We present here the results obtained with the magnetic detector DM2 on the Orsay e^+e^- colliding beams DCI for $1400 < S < 2250$ MeV. The total integrated luminosity is 1400 nb^{-1} over the whole energy range. Cross sections are given for e^+e^- annihilation into pantip, $\pi^+\pi^-\pi^0$, $\pi^+\pi^-\pi^+\pi^-$ and K^+K^-.

12904 **(LAL—83-22) Study of J/psi→γrhoγ and J/psi→γphiphi with the DM2 detector at DCI.** Augustin, J.E.; Ayach, L.; Calcaterra, S. (Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire). Jul 1983. 16p. (CONF-8308101—7). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750467.

From International symposium on lepton and photon interactions at high energies; Ithaca, NY, USA (4 Sep 1983).

Preliminary results from the DM2 experiment at DCI are presented on radiative transitions from J/psi. No evidence has been found for the decay J/psi→γiota iota→rhoγ and an upper limit is given. In the reaction J/psi→γphiphi two good candidates in the channel $\gamma K^+K^-K^+K^-$ have been observed.

12905 **(LBL—16889) Search for right-handed currents in muon decay.** Carr, J.; Gidal, G.; Gobbi, B.; Jodidio, A.; Oram, C.J.; Shinsky, K.A.; Steiner, H.M.; Stoker, D.; Strovink, M.; Tripp, R.D. (Lawrence Berkeley Lab., CA (USA); Northwestern Univ., Evanston, IL (USA). Dept. of Physics; British Columbia Univ., Vancouver (Canada). TRIUMF Facility). Apr 1983. Contract AC03-76SF00098. 19p. (CONF-830455—11). NTIS, PC A02/MF A01. Order Number DE84005196.

From Yamada conference on muon spin rotation and associated problems; Shimoda, Japan (18 Apr 1983).

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We report new limits on right-handed currents, based on precise measurement of the endpoint of the e^+ spectrum from μ^+ decay. Highly polarized μ^+ from the TRIUMF surface beam were stopped in pure metal foils within either an 1.1-T spin-holding longitudinal field, or a 70-gauss spin-precessing transverse field. Decay e^+ emitted within 200 mrad of the beam direction were momentum-analyzed to +-0.2%. For the spin-held data, decay via (V-A) currents requires the e^+ rate to approach zero in the beam direction at the endpoint. Measurement of this rate sets the 90% confidence limits xi P/sub μ/δ/rho > 0.9959 and M(W/sub R/) > 380 GeV, where W/sub R/ is the possible right-handed gauge boson. For the spin-precessed data we independently determine a 90% confidence limit xi P/sub μ/δ/rho > 0.9918. 18 references.

12906 **(LBL—16953) Recent results from the PEP4-TPC on quark fragmentation.** Hofmann, W. (Lawrence Berkeley Lab., CA (USA)). 12 Nov 1983. Contract AC03-76SF00098. 38p. (CONF-830817—3). NTIS, PC A03/MF A01;1. Order Number DE84004058.

From SLAC summer institute on particle physics; Stanford, CA, USA (16 Aug 1983).

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The physics goals for the PEP-4/PEP-9 experiment concentrate on two areas: the fragmentation properties of quarks and gluons produced in e+e- annihilation, and the investigation of hadron production in 2-photon collisions. Only the first of these topics is addressed. Despite the many successes of QCD in the description of deep inelastic reactions, the basic fragmentation process of quarks and gluons is not very well understood. This lack of knowledge has been shown to jeopardize precise test of QCD, such as the accurate determination of the strong coupling constant. With its ability to disentangle complex hadronic events and to identify most of the final state particles, the TPC allows new and more sensitive tests of fragmentation models. A brief description of the detector is given and particle identification by ionization energy loss is described. Next, the inclusive production of stable hadrons and of resonances is discussed, and limits on the inclusive production of fractional charged particles are given. A new analysis of long-range correlations in e+e- annihilation is given.

12907 **(PB—83-253930) Recent study of jets at the ISR.** Segar, A.M. (Oxford Univ. (UK). Nuclear Physics Lab.). 1983. 22p. NTIS, PC E03/MF E03.

A review of results on jets is presented, with emphasis on recent data which are tending to support the interpretation of high transverse momentum phenomena in QCD. Calorimeter trigger results which show two-jet structure at high (E sub T) approximately equals, or > 20 GeV are presented.

12908 **(PITHA—81/17) Study of quantum chromodynamical effects in the total cross section of the electron positron annihilation into hadrons.** Lackas, W. (Technische Hochschule Aachen (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). 17 Jul 1981. 111p. (In German). Fachinformationszentrum Energie, Physik, Mathematik, Karlsruhe (Germany, F.R.).

This thesis is concerned with the annihilation of electrons and positrons into hadrons. The data which were obtained by the detector PLUTO at the storage ring PETRA at c.m. energies of 12 - 31.6 GeV are analyzed. In the whole energy range a constant slope of the total cross section with R=sigmasub(tot)/sigmasub($\mu\mu$)=4.06+-0.10(stat.) +-0.20 (syst.) is shown. This value prefers the QCD expectation with Rsub(QCD)=3.87 instead of the naive quark-parton model with Rsub(QPM)=3.67. The calculation of αsub(s) resulting from sigmasub(tot) yields regarding the anti Manti S renormalization scheme: αsub(s)=0.30+-0.06(stat.)+-0.14(syst.) and therefore an exclusion of the naive quark-parton model by 2 standard deviations (95% c.l.) at quadratic addition of statistical and systematic errors. In addition the energy distributions, the mean multiplicities, and the inclusive energy spectra both for the charged and for the neutral contributions of the hadronic events are studied. The comparison with a qanti qg Monte Carlo code shows a very good agreement between the data and the theoretical predictions.

12909 **(SLAC-PUB—3260) Recent results from DELCO.** Atwood, W.B.; Baillon, P.H.; Barish, B.C.; Bonneaud, G.R.; DeStaebler, H.; Donaldson, G.J.; Dubois, R.; Duro, M.M.; Gao, S.G.; Huang, Y.Z. (Stanford Linear Accelerator Center, CA (USA); California Inst. of Tech., Pasadena (USA)). Nov 1983. Contract AC03-76SF00515. 16p. (CONF-8307109—5). NTIS, PC A02/MF A01. Order Number DE84005423.

From 11. SLAC summer institute conference on particle physics - dynamics and spectroscopy at high energy; Stanford, CA, USA (18 Jul 1983).

DELCO is a magnetic spectrometer with Cerenkoc, Time-of-Flight (TOF) and shower counters for particle identification. It is located in IR8 of the PEP storage ring. Data have been obtained at a center of mass energy, $\sqrt{s}$, of 29 GeV. We report on: (1) the

fraction of P, K, π in hadronic events; (2) the observation of direct electron signals; and (3) the measurement of D* fragmentation function and its total cross-section. 8 references.

6452 Particle Interactions And Properties - Theoretical

REFER ALSO TO CITATION(S) 12921

12910 **(DOE/ER/01545—342) Quark clusters and the EMC effect.** Clark, B.C.; Hama, S.; Mulligan, B.; Tanaka, K. (Ohio State Univ., Columbus (USA). Dept. of Physics). 1983. Contract AC02-76ER01545. 14p. NTIS, PC A02/MF A01. Order Number DE84005079.

A general cluster model description of the deep inelastic scattering structure functions is discussed. An application using 3-quark and 12-quark clusters gives reasonable agreement with the EMC data.

12911 **(PB—83-254193) Semi-empirical model for high energy inclusive reactions.** Wells, J. (Oxford Univ. (UK). Nuclear Physics Lab.). 1983. 57p. NTIS, PC E05/MF E05.

A resume of contemporary data on inclusive reactions in all high energy interactions is presented, and a new technique for the division of the inclusive cross-sections into beam residue, target residue and central components is discussed. A semi-empirical quark model is proposed which correctly describes all hadronically induced inclusive cross-sections above $\sqrt{}$ approximately = 3.0 GeV. The model is then extended to predict absolute cross-sections for lepton and photon induced reactions, a comparison with data shows the predictions to be essentially correct. Many qualitative features and puzzling aspects of current data are quantitatively explained by the model.

12912 **(PB—83-255745) Note on the fragmentation functions of discrete particles on the Artru-Mennessier string.** Bowler, M.G. (Oxford Univ. (UK). Nuclear Physics Lab.). 1983. 14p. NTIS, PC E03/MF E03.

The author investigated the fragmentation functions of particles containing a leading quark under the assumption that the (light quark) meson mass spectrum is effectively continuous above a mass of about 1 GeV but contains discrete pseudo scalars and vectors below 1 GeV. The author has required the production of these particles to saturate the string breaking probability for particles below 1 GeV and implemented this requirement in such a way that as the density of discrete states approaches infinity, the semi-classical results are recovered. The conclusion is that the fragmentation functions of the discrete particles are very close to those predicted for a particle of the appropriate mass in a continuous spectrum and that suppression of hadrons with increasing mass remains a feature of the model.

12913 **Hybrids: mixed states of quarks and gluons.** Chanowitz, M.; Sharpe, S. (Lawrence Berkely Lab., CA (USA)). *Nuclear Physics [Section] B;* **222**: No. 2, 211-244(1 Aug 1983).

With 44 refs.

We calculate the spectrum of the four ground state hybrid (anti qqg) nonets, Jsup(PC) = (0, 1, 2)$^{-+}$, 1^{--}, using the MIT bag model to first order in cavity perturbation theory. Quark and gluon self-energies are included by a fit to the s-wave mesons and baryons and to the glueball candidate i(1440). We find a large gluon self-energy which substantially increases our predictions of the glueball and hybrid masses. We discuss the phenomenology of hybrids, including a suggestion that the A_3(1670) and a second peak at 1850 MeV in the fπ channel may be mixtures of the isovector anti qq d-wave state with the anti qqg s-wave.

12914 **Family gauge symmetry from a composite model.** Zhou, B.R. (Fermi National Accelerator Lab., Batavia, IL (USA)); Chang, C.H. (New York Univ., NY (USA). Dept. of Physics; Princeton Univ., NJ (USA). Inst. for Advanced Study). *Physics Letters, [Section] B;* **127**: No. 3/4, 209-214(28 Jul 1983).

A family gauge symmetry SUsup(F)(2) could emerge from a composite model of quarks and leptons under some assumptions of chiral hyperflavor symmetry-breaking pattern. Possible dynamical mechanisms which break the family and electroweak gauge group and produce quark-lepton masses are indicated and their phenomenologies are discussed qualitatively.

12915 **Correlations and fluctuations in hadronic multiplicity distributions: The meaning of KNO scaling.** Carruthers, P.; Shih, C.C. (Los Alamos National Lab., NM (USA). Theoretical Div.). *Physics Letters, [Section] B;* **127**: No. 3/4, 242-250(28 Jul 1983).

Charged hadronic multiplicity distributions at Fermilab, ISR and collider energies are shown to be described by generalized Bose-Einstein distributions of the type encountered in quantum optics. Systematic energy-dependent deviations from KNO scaling are well described by simple cases of this formula, which in the limit of large anti n have a simple and explicit scaling form, valid to a few percent at the CERN collider energy. It is suggested that this framework is generic, i.e., practically independent of dynamical details. The essential feature is that the field variables of the 'radiant surface' for hadronic emission are distributed as gaussian random variables (with k effective sources) as suggested by a typical central limit theorem argument. In order to bring the lower energy data into a form easily comparable with higher energy data, particularly fohe crucial large multiplicity events (n/anti n) $>>$ 1, it is essential to remove the two charges of the 'leading' particles from the counting rules. The long tail of the KNO distribution is to be identified with coherent fluctuations analogous to those occurring in the Hanbury-Brown-Twiss effect.

12916 **Baryon spectroscopy.** Hey, A.J.G. (California Inst. of Tech., Pasadena (USA); Southampton Univ. (UK). Dept. of Physics); Kelly, R.L. (Lawrence Berkely Lab., CA (USA)). *Physics Reports: A Review Section of Physics Letters (Section C);* **96**: No. 2/3, 71-204(Jun 1983).

With many refs.

The subject of baryon spectroscopy is reviewed in some detail, from the viewpoints of theory and of the experimental data. In the theoretical section, the status of both pre- and post-QCD quark models is discussed. A brief account of methods of theoretical analysis is included in the section on baryon resonance experiments.

12917 **Quark mixing in weak interactions.** Chau, L.L. (Brookhaven National Lab., Upton, NY (USA). Physics Dept.). *Physics Reports: A Review Section of Physics Letters (Section C);* **95**: No. 1, 3-94(Apr 1983).

The status of the quark mixing in weak interaction is reviewed. The 3 x 3 quark mixing matrix for the three left-handed doublet model is analyzed using various experimental information involving strange, charmed, and b-flavored particles. Its interplay with nonleptonic decays, implication on neutral particle-antiparticle mixing and CP violation in heavy quark systems, and the possible origin of the quark mixing from quark mass matrix are discussed. Finally we briefly review the status of alternative sources for CP violation, and alternative models to the three left-hand quark doublet model.

6453 Particle Invariance Principles And Symmetries

12918 **(CEA-CONF—6764) Supersymmetric particle physics: a panorama.** Savoy, C.A. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Mar 1983. 206p. (CONF-830377—6). NTIS (US Sales Only), MF A01. Order Number DE84750425.

From 18. Rencontre de Moriond conference; La Plagne, France (19 Mar 1983).

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Supersymmetry is reviewed from a particle theorist viewpoint. The main underlying properties are described and confronted to the requirements of model building. The low-energy approximation to broken supergravity gauge theories is analysed, with some emphasis on the problem of the spontaneous breaking of SU(2)xU(1) invariance.

6454 Field Theory

REFER ALSO TO CITATION(S) 12914, 12918

12919 **(DOE/ER/02978—10) Inelastic strong interactions at high energies. Annual progress report, June 1, 1983-May 1, 1984.** Suranyi, P. (Cincinnati Univ., OH (USA)). 1984. Contract AC02-76ER02978. 7p. NTIS, PC A02/MF A01. Order Number DE84005666.

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Various methods giving increasingly more precise, but physically equivalent results were introduced for the investigation of U(1) lattice theories. The mass gap and string tension were calculated and deconfining phase transition points were estimated in Hamiltonian lattice theories by employing the variational and WKB methods and by constructing periodic Gaussian models. At weak coupling U(1) lattice theories (global or gauge) of d-dimension were shown to be equivalent to Z (integer valued) or Z(2) spin theories of d-1 dimensions. A systematic method for performing dimensional reduction on theories constructed in (D+n)-dimensional space-times, with or without torsion, which admit n Killing vectors was developed. For the case of n abelian Killing vectors the field contents and their equations of motion for the corresponding (d+n)-dimensional theories were completely worked out. An extended conformal theory of gravity was constructed and its local symmetries were compared to those of Einstein and Weyl. The extension to superspace was also studied.

12920 **Link fermions and dynamically correlated paths for lattice gauge theory.** Brower, R.C. (Harvard Univ., Cambridge, MA (USA). Lyman Lab. of Physics); Giles, R.C. (Massachusetts Inst. of Tech., Cambridge (USA). Lab. for Nuclear Science); Kessler, D.A. (Los Alamos National Lab., NM (USA). Theoretical Div.); Maturana, G. (California Univ., Santa Cruz (USA). Physics Dept.). *Physics Letters, [Section] B;* **126**: No. 5, 359-365(7 Jul 1983).

The calculation of fermion bound states in lattice QCD is discussed from the point of view of the Feynman path integral and the corresponding lattice 'path sum' representation of the fermion propagator. Path sum methods which correlate the trajectories of valence fermion and antifermion constituents of a meson bound state are presented. The resultant Monte Carlo algorithm for the meson propagator samples predominantly those configurations which are expected to be most important for a tightly bound system. Relative to other techniques, this procedure anticipates cancellations due to gauge field averaging, and in addition, allows a more detailed examination of the bound state wavefunction. Inspired by the fermionic path representation of the 2D Ising model, we also introduce a new class of lattice fermion actions with nearest neighbor interactions between Grassman variables associated with links. These link fermions are a simple generalization of Wilson's fermions. They have an additional corner weight parameter which can be adjusted to obtain a much improved dispersion relation for moderate and parge lattice momenta.

12921 **Solution to the strong CP problem in N=1 supergravity models.** Mohapatra, R.N.; Ouvry, S. (City Coll., New York (USA). Dept. of Physics); Senjanovic, G. (Brookhaven National Lab., Upton, NY (USA). Physics Dept.). *Physics Letters, [Section] B;* **126**: No. 5, 329-333(7 Jul 1983).

We point out that the simplest embedding of the SU(2)sub(L)xU(1) weak interactions model in N = 1 supergravity leads to an effective theory at low energies with a softly broken Peccei-Quinn symmetry. The combined impact of this soft breaking and supergravity is then to produce a finite and negligible small strong CP parameter: tau < or approx. 10^{-20}, thus predicting invisible strong CP violation.

12922 **Monte Carlo computations in lattice gauge theories.** Creutz, M. (Brookhaven National Lab., Upton, NY (USA). Physics Dept.); Jacobs, L. (California Univ., Santa Barbara (USA). Inst. for Theoretical Physics); Rebbi, C. (Brookhaven National Lab., Upton, NY (USA). Physics Dept.). *Physics Reports: A Review Section of Physics Letters (Section C);* **95**: No. 4, 203-282(Apr 1983).

With 120 refs.

The formulation of gauge theories on Euclidean space-time lattices and the application of the Monte Carlo computational technique to the ensuing systems are reviewed. A variety of numerical results obtained for lattice gauge theories are presented and discussed.

65 PHYSICS. II.

12923 **(AEC—604) Report on applications of nuclear science in New Zealand 1979-80.** (New Zealand Atomic Energy Committee, Lower Hutt). Sep 1980. 149p. NTIS (US Sales Only), PC A07/MF A01. Order Number DE83704370.

This report describes the more important applications of nuclear science at various centres in New Zealand with emphasis on those involving research or new developments. The work within Goverment departments, universities, hospitals and industry is summarised, and this is followed by the main reports.

12924 **(INS-R—285) Annual report. January-December 1978.** (Department of Scientific and Industrial Research, Lower Hutt (New Zealand). Inst. of Nuclear Sciences). Feb 1981. 83p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE83704371.

The research programme of the Institute of Nuclear Sciences during the period January - December 1978 is described.

12925 **(INS-R—286) Annual report. January-December 1979.** (Department of Scientific and Industrial Research, Lower Hutt (New Zealand). Inst. of Nuclear Sciences). Jun 1981. 87p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE83704372.

The research programme of the Institute of Nuclear Sciences for the period January-December 1979 is described.

12926 **(INS-R—287) Nuclear Physics Group progress report. July-December 1980.** McCallum, G.J. (ed.). (Department of Scientific and Industrial Research, Lower Hutt (New Zealand). Inst. of Nuclear Sciences). Feb 1981. 23p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704373.

The work of the Nuclear Physics Group of the Institute of Nuclear Sciences during the period July-December 1980 is described.

12927 **(INS-R—289) Annual report, January-December 1980.** (Department of Scientific and Industrial Research, Lower Hutt (New Zealand). Inst. of Nuclear Sciences). Jan 1982. 87p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE83704374.

The research programme of the Institute of Nuclear Sciences for the period January-December 1980 is described.

12928 **(INS-R—294) Nuclear Physics Group progress report. January-June 1981.** Coote, G.E. (ed.). (Department of Scientific and Industrial Research, Lower Hutt (New Zealand). Inst. of Nuclear Sciences). Dec 1981. 22p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704375.

The work of the Nuclear Physics Group of the Institute of Nuclear Sciences during the period January-June 1981 is described.

6510 Nuclear Physics

REFER ALSO TO CITATION(S) 12588

12929 **(LYCEN—8301) Annual report 1982.** (Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire). [nd]. 95p. (In French). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84750424.

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This annual report describes the work during 1982 of the Nuclear Physics Institute of Lyon. The achievement of SARA postaccelerator in Grenoble, realized in collaboration with the Nuclear Science Institute, permits to pursue new lines of research in heavy ion physics. A new isotope separator was realized by the nuclear spectroscopy group and the high energy experimental group cooperates with the LAPP to build in international collaboration the L3 detector for LEP. The topics covered include theoretical physics, high energy and intermediate energy physics, nuclear physics and interdisciplinary physics, such as solid state physics and neutronics.

12930 **(PB—83-251363) Photonuclear data index, 1973-1981 (supplement 2 to NBS (National Bureau of Standards) special publication 380).** Fuller, E.G.; Gerstenberg, H. (National Bureau of Standards, Washington, DC (USA). Radiation Physics Div.). Aug 1983. 155p. NTIS, PC A08/MF A01.

This index, a supplement to NBS Special Publication 380, Photonuclear Reaction Data, 1973, primarily covers data published in the period from January 1973 through December 1981. It supersedes the first supplement to Special Publication 380 issued in August 1978. Organized by element and isotope, each entry in the index is for a specific reaction reported in a given reference. Information is given on the type of measurement, excitation energies studied, source type and energies, detector type and angular ranges covered in the measurement. Also included is an index to the more than 1200 data sets currently available in the Photonuclear Data Group's digital data library.

6511 Experimental Techniques

REFER ALSO TO CITATION(S) 12518, 12587

12931 **(CONF-8309127—7) New foil stretcher for recoil distance targets and stoppers.** Radford, D.C. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 13p. NTIS, PC A02/MF A01. Order Number DE84005414.

From International Nuclear Target Society workshop; Argonne, IL, USA (7 Sep 1983).

A new design for a target holder to produce stretched foils for recoil-distance (plunger) lifetime measurements is described. The foil tension is obtained by compression of an O-ring in contact with the foil, which is thereby stretched over an aluminum tube, one end of which has been optically polished. The new stretchers have been used in an actual measuremnt with the ANL plunger apparatus, and were found to be fully satisfactory. Using two gold foils, a minimum distance of 3 μm before electrical contact has been obtained. The main advantage of the new holders is the ease and reliability with which good quality stretched foils can be produced. Using evaporated gold foils of about 2 mg/cm^2 thickness, a success rate of close to 100% can be achieved with a little practice.

12932 **(FRNC-TH—1304) Study of resonances in ^{16}O, ^{28}Si elastic scattering near the Coulomb barrier.** Chavez-Lomeli, E.R. (Strasbourg-1 Univ., 67 (France)). Jun 1983. 93p. (In French). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84750419.

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The ^{28}Si + ^{16}O elastic scattering has been studied above the Coulomb barrier. Height angular distributions has been measured and analyzed between 18.67 MeV and 22.29 MeV center of mass energy. An optical model analysis shows that the very deep and transparent potentials reproduce the oscillations at back angles of the angular distributions. This result is confirmed by a coupled equation analysis of the elastic and inelastic scattering of the first 2$^+$ state of ^{28}Si. A semi-classical analysis shows a pole in these very transparent optical potentials. An analysis with only one Regge pole by angular distribution reproduces perfectly the data. An phase shift analysis confirms the presence of resonant quasi-molecular states of short lifetime with overlapping width to explain the first structure observed in the excitation function measured at 180^0 in the center of mass. A spin value has been assigned at these resonant states.

12933 **(IPNO-DRE—83-18) β-delayed neutrons from very neutron-rich sodium and magnesium isotopes.** Langevin, M.; Detraz, C.; Guillemaud-Mueller, D.; Mueller, A.C.; Thibaut, C.; Touchard, F.; Epherre, M. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1983. 24p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750477.

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β-delayed neutron yields from ^{29}Na to ^{34}Na are measured with a high efficiency liquid scintillator neutron detector. Ph values and half-lives are deduced for ^{29}Na to ^{34}Na and ^{31}Mg to ^{34}Mg descendants.

12934 **(PB—83-255067) Optical potential description of (16)O + (28)Si elastic scattering.** Kobos, A.M.; Satchler, G.R.; Mackintosh, R.S. (Oxford Univ. (UK). Nuclear Physics Lab.). 1982. 19p. NTIS, PC E03/MF E03.

Elastic scattering data for ^{16}O + ^{28}Si were analyzed using a local optical potential model whose real part consists of a double-folded potential supplemented by a phenomenological model-independent correction term. A good fit for energies between 21 and 35 MeV was obtained over the whole angular range from 20 degrees to 180 degrees. The real correction term was found to be predominantly attractive and to have a structure which varies little with bombarding energy. The associated imaginary potentials imply surface transparency and have detailed structure which varies rapidly with energy. A systematic trend for the absorptive region to extend to larger radii as the energy increases was noted. A simple parameterization of this trend enabled the main features of the excitation function for 180 degree scattering to be reproduced.

6515 Nuclear Properties And Reactions, A=39-58, Theoretical

12935 **(IPNO-DRE—83-15) Excitation of M1 resonances by medium energy protons.** Crawley, G.M.; Djalali, C.; Marty, N. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1983. 25p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750479.

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The results of 201 MeV (p,p') studies of ΔL=0 spin-flip transitions at very forward angles are discussed. The reasons for making comparisons between (p,p'), (p,n) and electromagnetic measurements of M1 transitions are outlined. After presenting some of the experimental and theoretical uncertainties, a summary of the results on the Zr isotopes plus other nuclei to mass 140 is given. Results from ^{48}Ca, the N=28 nuclei ^{50}Ti, ^{51}V, ^{52}Cr and ^{54}Fe are discussed and compared with (p,n) and electromagnetic measurements. In the Ni isotopes, the T_0 and T_0+1 components of the 1$^+$ spin-flips transition were observed both in (p,p') and in (p,n) reactions.

12936 **(IPNO-DRE—83-17) ^{53}K, ^{54}K and ^{53}Ca: three new neutron rich isotopes.** Langevin, M.; Detraz, C.; Guillemaud-Mueller, D. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1983. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750478.

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β-delayed neutron yields from ^{49}K to ^{54}K were measured with a high efficiency liquid scintillator neutron detector. Three new nuclides have been identified; half lives have been determined for ^{50}K, ^{51}K, ^{52}K, ^{53}K and ^{54}K isotopes and ^{53}Ca daughter, Pn have been measured for ^{49}K, ^{50}K, ^{51}K, ^{52}K and ^{53}K.

12937 **(PB—83-254227) Nucleon momentum distributions of 39(K), 40(Ca) and 48(Ca).** Antonov, A.N.; Nikolaev, V.A.; Petkov, I.Zh.; Hodgson, P.E. (Oxford Univ. (UK). Nuclear Physics Lab.). 1983. 19p. NTIS, PC E03/MF E03.

The proton momentum distributions of (39)K,(40)Ca and (48)Ca are calculated from the model-independent charge distributions obtained from analyses of electron elastic scattering and muonic atoms, and also from the charge distributions calculated from the single-particle potential method in the framework of the fluctuon model. The sensitivities of the momentum distribution to different regions of the charge distribution are determined. The

analysis is extended to the neutron distributions using the single-particle potential method, and the differences between the proton and neutron momentum distributions are examined. The resulting momentum distribution in the case of (40)Ca is used for analyzing the quasielastic electron scattering.

12938 **Isobaric analogue resonances in the ^{41}K and ^{65}Cu(p,n) reactions.** Saini, S. (Argonne National Lab., IL); Singh, G.; Chatterjee, A.; Kailas, S.; Karnik, D.D.; Mehta, M.K.; Veerabahu, N. *Nuclear Physics [Section] A;* **405**: No. 1, 55-68(22 Aug 1983).

The total (p, n) reaction cross sections for ^{41}K and ^{65}Cu have been measured as a function of proton energy in the energy ranges 1.46-4.10 and 2.25-4.20 MeV, respectively. Several prominent isobaric analogue resonances have been identified. A detailed shape analysis of these isobaric analogue resonances has been performed to determine the proton width GAMMAsub(p), the spreading width W and the spectroscopic factor Ssub(n) for the various resonances.

12939 **Core excitations and M1 strengths in the Ca isotopes.** Brown, B.A.; Horen, D.J.; Castel, B.; Toki, H. (Oak Ridge National Lab., TN (USA)). *Physics Letters, [Section] B;* **127**: No. 3/4, 151-154(28 Jul 1983).

The existence of strong M 1 transitions from T = 1 and T = 2 states in ^{40}Ca provides an interesting challenge to nuclear structure models. We show that the recent M 1 data can be reconciled with a shell model study of ^{40}Ca and that the fragmentation and disappearance of strengths in ^{42}Ca and ^{44}Ca is consistent with a weak-coupling extension of the ^{40}Ca system in which the M 1 strength is divided among Tsub(z) and Tsub(z+1) components.

12940 **(IPNO-DRE—83-22) Mass and excited levels of the neutron-rich nuclei ^{73}Zn and ^{74}Zn studied with ^{76}Ge(^{14}C,^{16}O) and (^{14}C,^{17}O) reactions.** Bernas, M.; Dessagne, P.; Langevin, M. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1983. 21p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750480.

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The ^{76}Ge(^{14}C,^{15}O,^{17}O)^{74}Zn,^{73}Zn reactions have been studied at 72 MeV bombarding energy. The mass excesses of ^{73}Zn and ^{74}Zn were determined to be -65.41+-.04 and -65.62+-.04 MeV, respectively. In addition previously unknown excited levels were identified in both nuclei. The structure of ^{73}Zn is discussed in terms of H.F.B. calculations.

12941 **Study of the ^{63}Cu(n,γ)^{64}Cu reaction.** Delfini, M.G.; Kopecky, J.; de Haas, J.B.M.; Liou, H.I.; Chrien, R.E.; Endt, P.M. (Stichting voor Fundamenteel Onderzoek der Materie, Petten, Netherlands). *Nuclear Physics [Section] A;* **404**: No. 2, 225-249(8 Aug 1983).

With 30 refs.

The γ-radiation resulting from the capture of unpolarized thermal, 2 and 24 keV neutrons in enriched ^{63}Cu, and of polarized thermal neutrons in ^{63}Cu oriented at low temperature has been investigated. Of the 323 γ-rays observed 299 could be placed in a ^{64}Cu level scheme containing 109 levels. The reaction Q-value amounts to 7916.09(12) keV. The Z^2 analysis of the γ-ray angular distributions obtained from capture of polarized neutrons in oriented ^{63}Cu resulted in three unambiguous spin assignments for levels in ^{64}Cu. The fraction of the Jsup(π) = 1^- channel in the thermal capture was determined as (94 +- 2)%. For one level an unambiguous spin assignment has been obtained from the decay scheme.

12942 **Study of the ^{65}Cu(n,γ)^{66}Cu reaction.** Delfini, M.G. (Stichting voor Fundamenteel Onderzoek der Materie, Petten, Netherlands); Kopecky, J.; Liou, H.I.; Chrien, R.E.; Endt, P.M. *Nuclear Physics [Section] A;* **404**: No. 2, 250-268(8 Aug 1983).

Capture of polarized thermal, unpolarized thermal, 2 and 24 keV neutrons in enriched ^{65}Cu has been investigated. Of the observed 424 γ-rays 346 could be placed in a level scheme including 99 levels. The reaction Q-value amounts to 7065.97(11) keV. Gamma-ray circular polarization analysis suggests that thermal capture is dominated by the Jsup(π) = 2^- component in the capture state and results in unambiguous spin assignments for some low-lying levels. For six more levels unambiguous spin assignments have been obtained from the decay scheme.

6517 Nuclear Properties And Reactions, A=90-149, Theoretical

12943 **(FRNC-TH—1263) Levels structures of Cd-114.** Mheemeed, A. (Grenoble-1 Univ., 38 (France)). Oct 1981. 106p. (In French). NTIS (US Sales Only), MF A01. Order Number DE84750422.

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The level structures of ^{114}Cd up to an excitation energy of 3.6 MeV have been investigated. Gamma radiation following thermal neutron capture in ^{113}Cd in the energy region from 50 keV to 2.2 MeV has been measured by means of the three curved-crystal γ-ray spectrometers, GAMS 1 and GAMS 2/3 at the I.L.L. reactor. Internal conversion electrons have been measured with the electron spectrometer BILL installed at the I.L.L. Several targets were prepared by the evaporation or sedimentation technique in order to measure the electrons in the energy region from 40 keV to 8.5 MeV. Multipolarities for a large number of transitions were determined. Primary γ-ray following average resonance neutron capture at Esub(n) = 2 keV and 24 keV were recorded at the Brookhaven National Laboratory resulting in a complete set of levels with Isup(π) <=3^{+-} up to 3 MeV excitation energy. Combining these results a level scheme up to 3.6 MeV has been constructed.

12944 **Reliability of resonance-averaged neutron-capture measurements.** Raman, S.; Shahal, O. (Oak Ridge National Lab., TN (USA)); Kenny, M.J.; Chrien, R.E. (Brookhaven National Lab., Upton, NY (USA)). *Journal of Physics G: Nuclear Physics;* **9**: No. 7, L137-L139(Jul 1983).

It is shown that well established levels (within a limited spin range) in ^{146}Nd below 2.2 MeV are indeed populated by primary transitions in '2 keV neutrons' resonance-averaged capture (RAC) measurements. Therefore, an apparent failure to identify crucial levels in ^{146}Nd from previous 'reactor-neutrons' RAC measurements is not a valid basis for questioning the general reliability of the RAC method for level identification.

6519 Nuclear Properties And Reactions, A=190-219, Theoretical

12945 **(FRNC-TH—1303) Determination of Pb total photonuclear absorption cross section in the Δ resonance range by measurement of photoneutrons cross sections.** Chollet, C. (Paris-7 Univ., 75 (France)). May 1983. 104p. (In French). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84750418.

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The photonuclear absorption cross section of Pb, σ(TOT:Esub(γ), is studied in the 145-440 MeV Δ resonance range using a quasi-monochromatic photon beam obtained by monoenergetic positon in-flight annihilation. This study is deduced of the cross section measurement for at least j neutron emission σsup(j))Esub(γ). The cross sections of reactions with 1 or 0 neutron are evaluated as the same values as the experimental errors. The variation of the photonuclear absorption cross section for a nuclear σ(TOT:Esub(γ)/A is mass independent for A<=4-6. It seems that the damping between σ(TOT:Esub(γ)/A and the cross section of the free nucleon is caused by the Fermi movement of the nucleons. In conclusion: it seems that the excitation of the nucleus in the Δ resonance region is produced on free nucleons and there are no collective states.

6520 Nuclear Properties And Reactions, A=220 And Above, Theoretical

12946 (CEA-CONF—6737) Evaluation of ^{237}Np neutron cross sections between 5 and 16 MeV. Study of the (n, 2n) reaction and application to ^{236}Pu production calculations. Fort, E.; Derrien, H.; Doat, J.P. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France)). Sep 1982. 6p. (In French). (CONF-820942—37). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750427.

From Nuclear data for science and technology international conference; Antwerp, Belgium (6 Sep 1982).

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Neutron reactions on ^{237}Np (fission and n, 2n) reaction) are important for dosimetry and for the production of ^{236}Np → ^{236}Pu. This nuclide is the beginning of the decay chain leading to ^{208}Pb (α ray emitter, Esub(α) = 2.614 MeV). A precise calculation of the ^{236}Pu production during irradiations is required for optimizing shieldings needed for reprocessing and fuel transport.

12947 (FRNC-TH—1302) Momentum transfer study of the reactions induced by light particles (p, d, α) between 70 and 1000 MeV. Saint-Laurent, F. (Paris-11 Univ., 91 - Orsay (France)). Apr 1983. 150p. (In French). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84750420.

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Angular distribution and correlations of fission fragment induced by light projectiles (p,d,α) on ^{232}Th and ^{197}Au targets from 70 to 1000 MeV have been measured. The distributions of the forward component of the linear momentum imparted to the target nucleus are deduced. They give information about the dominating process leading to fission on a wide range in energy. We propose a classification into three different regimes. Analysis is made with two high energy models: - intra-nuclear cascade model, in which the collison is described with incoherent successive nucleon-nucleon collisions; - a model, called absorption, which is an extension of the fireball model, completely developped by ourself. One of the main results of this analysis is that at twice the Fermi energy the collective effects must be take into account for light projectiles.

12948 (PB—83-253922) Inelastic scattering of neutrons by uranium 238. Hodgson, P.E. (Oxford Univ. (UK). Nuclear Physics Lab.). 1982. 21p. NTIS, PC E03/MF E03.

A simple method was developed for calculating neutron inelastic scattering cross sections. At energies of a few MeV, the direct and compound processes contribute to the cross section, the cross section in any channel at any angle and energy being the sum of the direct interaction and compound nucleus contributions. The direct interaction cross sections were obtained by the distorted wave theory using the computer program CHUCK. The compound nucleus cross sections were calculated from the Hauser-Feshbach theory using the program of Wilmore (1966) with the formalism introduced by Tepel et al (1974) to take account of channels with medium and strong absorption. The results compared well with those from experimental studies and the method was used with some confidence to calculate unknown cross sections.

12949 (UCID—19980) Nuclear modeling of the ^{239}Pu(n,xn) excitation function. Blann, M.; White, R.M. (Lawrence Livermore National Lab., CA (USA)). Jan 1984. Contract W-7405-ENG-48. 37p. NTIS, PC A03/MF A01. Order Number DE84006264.

Calculated excitation functions for the (n,2n) and (n,3n) reactions on ^{239}Pu are presented. In these calculations precompound plus compound decay models with experimentally deduced fission probabilities are used. A range of results are presented indicating the uncertainty in the model calculations. Experimental measurements which would constrain the range of modeled result are suggested. 21 references.

6530 Nuclear Theory

REFER ALSO TO CITATION(S) 12879, 12911

12950 (PB—83-253914) Nucleon scattering and reactions. Hodgson, P.E. (Oxford Univ. (UK). Nuclear Physics Lab.). 1983. 37p. NTIS, PC E04/MF E04.

Recent advances in the fundamental calculation of the nucleon optical potential from the nucleon-nucleon interaction and the nuclear density distributions are reviewed, with particular attention to the understanding of the anomaly in the real part of the potential around the Fermi energy. Some data that pose a challenge to theories of the nucleon-nucleon interaction are examined, together with detailed systematics of nuclear RMS charge radii. The application of optical model and distorted wave theory to analyse neutron elastic and inelastic scattering is described.

12951 (PB—83-254219) Nucleon optical potential. Hodgson, P.E. (Oxford Univ. (UK). Nuclear Physics Lab.). 1983. 40p. NTIS, PC E04/MF E04.

Contents: Phenomenological analyses – The energy dependence of the real potential, The radial variation of the real potential, The imaginary potential; Nuclear matter calculations; The spin-orbit potential; The isospin potential; General features of the nucleon optical potential.

12952 Nonlinear mean field theory for nuclear matter and surface properties. Boguta, J. (Lawrence Berkely Lab., CA (USA)); Moszkowski, S.A. (California Univ., Los Angeles (USA)). *Nuclear Physics [Section] A;* 403: No. 3, 445-468(25 Jul 1983).

Nuclear matter properties are studied in a nonlinear relativistic mean field theory. We determine the parameters of the model from bulk properties of symmetric nuclear matter and a reasonable value of the effective mass. In this work, we stress the nonrelativistic limit of the theory which is essentially equivalent to a Skyrme hamiltonian, and we show that most of the results can be obtained, to a good approximation, analytically. The strength of the required parameters is determined from the binding energy and density of nuclear matter and the effective nucleon mass. For realistic values of the parameters, the nonrelativistic approximation turns out to be quite satisfactory. Using reasonable values of the parameters, we can account for other key properties of nuclei, such as the spin-orbit coupling, surface energy, and diffuseness of the nuclear surface. Also the energy dependence of the nucleon-nucleus optical model is accounted for reasonably well except near the Fermi surface. It is found, in agreement with empirical results, that the Landau parameter F_0 is quite small in normal nuclear matter. Both density dependence and momentum dependence of the NN interaction, but especially the former, are important for nuclear saturation. The required scalar and vector coupling constants agree fairly well with those obtained from analyses of NN scattering phase shifts with one-boson-exchange models. The mean field theory provides a semiquantitative justification for the weak Skyrme interaction in odd states. The strength of the required nonlinear term is roughly consistent with that derived using a new version of the chiral mean field theory in which the vector mass as well as the nucleon mass is generated by the sigma-field.

6540 Radiation And Shielding Physics

REFER ALSO TO CITATION(S) 12010

12953 (CEA-CONF—6736) Nuclear data fitting from specific integral experiments for structural materials. Trapp, J.P. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France)). Sep 1982. 7p. (In French). (CONF-820942—36). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750426.

From Nuclear data for science and technology international conference; Antwerp, Belgium (6 Sep 1982).

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Experiments on neutron propagation in sodium and steel-sodium mixtures carried out at Cadarache and Casaccia are re-

viewed and discussed. A good representation is given of FBR parameters (heat flux, secondary sodium activation). The interpretation of these experiments enabled Ni, Cr, Fe and Na cross sections to be fitted and lead to a reduction of the experiment-calculation deviations.

12954 **(CEA-CONF—6807) Sensitivity and uncertainty analysis in shielding using SN and Monte Carlo codes.** Dejonghe, G.; Gonnord, J.; Nimal, J.C. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). May 1983. 10p. (CONF-830538—23). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750443.

From 6. international conference on radiation shielding; Tokyo, Japan (16 May 1983).

We present the theories of perturbation, sensitivity and uncertainty analysis and the PEST system of codes based on SN and Monte Carlo methods and used in our laboratory.

12955 **(CEA-CONF—6808) THEMIS-4: a coherent punctual and multigroup cross section library for Monte Carlo and SN codes from ENDF/B4.** Dejonghe, G.; Gonnord, J.; Monnier, A.; Nimal, J.C. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). May 1983. 12p. (CONF-830538—22). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750442.

From 6. international conference on radiation shielding; Tokyo, Japan (16 May 1983).

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The THEMIS cross section processing system has been developped to produce punctual data for MONTE CARLO and coherent multigroup data for SN codes from ENDF/B. The THEMIS-4 data base has been generated from ENDF/B4 using the system and can be accessed by the 3-D Monte Carlo system TRIPOLI-2 and by the SN codes ANISN and DOT. An interpretation of ORNL fusion shielding benchmark is presented.

12956 **(CEA-CONF—6809) TRIPOLI-2: neutron gamma coupling - applications to shielding benchmarks and designs.** Cramer, S.N.; Dejonghe, G.; Gonnord, J.; Nimal, J.C.; Vergnaud, T. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). May 1983. 10p. (CONF-830538—21). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750437.

From 6. international conference on radiation shielding; Tokyo, Japan (16 May 1983).

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Recent additions in the on-going development of the TRIPOLI Monte Carlo code system include conversion to the ENDF/B data format and an automated coupling scheme for neutron secondary gamma-ray calculations. Two shielding calculations are presented here which feature these two new developments.

12957 **(CEA-CONF—6810) Gamma-ray streaming in bent ducts and voids.** Bourdet, L.; Nimal, J.C.; Vergnaud, T. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). May 1983. 8p. (CONF-830538—24). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750444.

From 6. international conference on radiation shielding; Tokyo, Japan (16 May 1983).

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We have developed an analytical method to calculate gamma-ray streaming through straight ducts and a numerical method to study the gamma propagation in bends or in annular clearances. The whole set allows a rigorous treatment of gamma streaming through bent ducts. In the same time a Monte Carlo method allows to study any form of geometry, by using sophisticated biasing techniques. All these developments are made with a simplified albedo. An easy to use code is also proposed to calculate very general albedos and a code to calculate the dose rate due to reflection in a room. Gamma dose rate albedos are determined for all elements and the energy range which concerns fission reactors.

12958 **(CEA-CONF—6811) Shielding design for PWR in France.** Champion, G.; Charransol; Le Dieu de Ville, A.; Nimal, J.C.; Vergnaud, T. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). May 1983. 10p. (CONF-830538—26). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750446.

From 6. international conference on radiation shielding; Tokyo, Japan (16 May 1983).

Shielding calculation scheme used in France for PWR is presented here for 900 MWe and 1300 MWe plants built by EDF the French utility giving electricity. Neutron dose rate at areas accessible by personnel during the reactor operation is calculated and compared with the measurements which were carried out in 900 MWe units up to now. Measurements on the first French 1300 MWe reactor are foreseen at the end of 1983.

12959 **(CEA-N—2352) Transport equation solution by the even parity method. Numerical study of the transport evolution equation in two-dimensional Lagrangian geometry R-Z.** Verwaerde, D. (CEA Centre d'Etudes de Limeil, 94 - Villeneuve-Saint-Georges (France)). May 1983. 62p. (In French). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84750481.

To get rid of visible sides problems, while solving Boltzmann equation on Lagrangian mesh, an even parity equation has been developed in 2D geometry. A conformous finite element method discretization is given by its week formulation and its mathematical relation ship with diffusion equation is showed. So, a compatible discretization for these equation is got for studying geometrical coupling between transport and diffusion, synthetic diffusion acceleration method and pre-conditionning for conjugate gradient.

12960 **(PB—84-118603) Photon absorption graphs 1 keV-10 MeV.** Bom, V.R.; Hollander, R.W. (Technische Hogeschool Delft (Netherlands). Lab. voor Technische Natuukunde). Jan 1983. 28p. NTIS, PC E04/MF E01.

The graphs are based on 'Photon Cross Sections from 1 keV to 100 MeV for Elements Z=1 to Z=100' by E. Storm and H.I. Israel, Nuclear Data Tables A7(6) 1970 p. 565. The interaction lengths are displayed in the graphs. The energy scale can be taken from the transparancy. The vertical line at the left corresponds to 1 keV. The transmission can be read directly by adjusting the arrow on the right on the thickness of the material.

12961 **(SAND—83-1797C) Synthetic acceleration scheme for radiative diffusion calculations.** Morel, J.E.; Larsen, E.W.; Matzen, M.K. (Sandia National Labs., Albuquerque, NM (USA); Los Alamos National Lab., NM (USA)). 1983. Contract AC04-76DP00789. 51p. (CONF-8310178—3). NTIS, PC A04/MF A01. Order Number DE84005519.

From 2. international conference and workshop on radiative properties of hot dense matter; Sarasota, FL, USA (31 Oct 1983).

A synthetic method has been developed to accelerate the iterative convergence of the multigroup radiative diffusion equations with temporally implicit material-radiation coupling. The performance of the method is characterized by means of a Fourier analysis. Computational results are given and are found to be consistent with the analysis. Overall, the method appears to be quite effective. 11 references.

6550 Medical Physics

12962 **(FRNC-TH—1116) Dosimetric characterization of interstitial radiotherapy sources: application to iridium 192.** Herrero, J. (Toulouse-3 Univ., 31 (France)). Oct 1982. 132p. (In French). NTIS (US Sales Only), PC A07/MF A01. Order Number DE83704228.

^{192}Ir interstitial radiotherapy sources have been characterized in terms of normal kerma-rate in air ksub(n), with an air-filled graphite cavity chamber of known volume, thus leading to primary standards. The distribution of absorbed dose in water has been studied, at different depths in a phantom, with an intracavitary chamber and with lithium fluoride thermoluminescent dosemeters. These two experimental investigations, complemented with the establishment of a rigorous formalism, made it possible to determine the

transmission function phi(d) in water, which is used in calculation codes for interstitial therapy. The values thus obtained are then compared to these previously published.

12963 **Soft tissue dosimetry of radium in humans--I: alpha-particle doses from the decay of ^{226}Ra and ^{228}Ra in soft tissues.** Keane, A.T.; Schlenker, R.A. (Argonne National Lab., IL). *Health Physics;* **44**: No. Sup. 1, 81-89(1983).

Estimates are presented of the α particle doses accumulated by individual organs and soft tissues of Reference Man in a 50-yr period following single intakes of ^{226}Ra and ^{228}Ra. With no decay of ^{226}Ra daughter products in soft tissue, the median dose is 67 mrad per μCi ^{226}Ra intake. With no translocation of ^{228}Ra daughter products, the dose per μCi ^{228}Ra is 5.77 times the corresponding value for ^{226}Ra. Biological variability introduces substantial uncertainty when applying these estimates to a particular individual.

6560 Solid State Physics

12964 **(DOE/ER/10866—T3) Dynamical threshold behavior of a sliding charge density wave.** Sokoloff, J.B. (Northeastern Univ., Boston, MA (USA). Dept. of Physics). 1983. Contract AC02-81ER10866. 14p. NTIS, PC A02/MF A01. Order Number DE84004304.

It is argued that the existence of a dynamical threshold field [i.e. the value of the electric field such that when the applied field is reduced to this value the charge density wave (CDW) stops sliding] requires that the sliding of the CDW at low center of mass velocities occur as local sudden jumping motion reminiscent of stick-slip friction. 20 references.

12965 **(SAND—83-25679C) Structural phase transitions at high pressure: quantum effects.** Samara, G.A. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 8p. (CONF-840140—1). NTIS, PC A02/MF A01. Order Number DE84005724.

From International symposium on solid state physics under pressure; Izu-Nagaoka, Japan (18 Jan 1984).

Pressure is an excellent variable to study the manifestation of quantum fluctuations in the properties of phase transitions in ferroelectrics and antiferroelectrics. Results on pure crystals agree with theory; however, results on mixed KTa/sub 1-x/Nb/sub x/O_3 crystals with $x \leqq 0.02$ show departures from theory. The pressure results provide an explanation for these departures and shed new light on the nature of the transition in these materials.

6561 Superconductivity

REFER ALSO TO CITATION(S) 12380

6570 Theoretical Physics

12966 **(AD-A—131783/3) New results for transition probabilities in two-level systems: the large detuning regime.** Robinson, E.J.; Berman, P.R. (New York Univ., NY (USA). Dept. of Physics). 7 Dec 1982. 27p. NTIS, PC A03/MF A01.

The problem of calculating transition probabilities in two-level systems is studied in the limit where the detuning is large compared to the inverse duration of the interaction. Within each family, transition probabilities may be calculated from formulae that differ only in the numerical value of a scaling parameter. In cases where the coupling function has a pole in the complex time plane, the families are identified with the order of this singularity. In particular, for poles of first order, a connection with the Rosen-Zenet solution can be made. The analysis is performed via high-order perturbation expansions, which are shown to always converge for two-level systems driven by coupling potentials of finite pulse area.

12967 **(LBL—16754) Chemical application of diffusion quantum Monte Carlo.** Reynolds, P.J.; Lester, W.A. Jr. (Lawrence Berkeley Lab., CA (USA)). Oct 1983. Contract AC03-76SF00098. 18p. (CONF-8310246—1). NTIS, PC A02/MF A01. Order Number DE84005173.

From NASA/Goddard-CDC symposium on CYBER 205 applications; Lanham, MD, USA (11 Oct 1983).

The diffusion quantum Monte Carlo (QMC) method gives a stochastic solution to the Schrodinger equation. This paper gives as an example the singlet-triplet splitting of the energy of the methylene molecule CH_2. The QMC algorithm was implemented on the Cyber 205, first as a direct transcription of the algorithm running on our VAX 11/780, and second by explicitly writing vector code for all loops longer than a crossover length C. The speed of the codes relative to one another as a function of C, and relative to the VAX is discussed. Since CH_2 has only eight electrons, most of the loops in this application are fairly short. The longest inner loops run over the set of atomic basis functions. The CPU time dependence obtained versus the number of basis functions is discussed and compared with that obtained from traditional quantum chemistry codes and that obtained from traditional computer architectures. Finally, preliminary work on restructuring the algorithm to compute the separate Monte Carlo realizations in parallel is discussed.

12968 **(LBL—16954) Achieving chemical accuracy by quantum Monte Carlo.** Lester, W.A. Jr.; Reynolds, P.J. (Lawrence Berkeley Lab., CA (USA)). Aug 1983. Contract AC03-76SF00098. 7p. (CONF-8308155—1). NTIS, PC A02/MF A01. Order Number DE84005175.

From Workshop on energetic material initiation fundamentals; Chestertown, MD, USA (15 Aug 1983).

In order to better understand the processes resulting in the release of chemical energy, one needs a computational technique of high accuracy. One alternative approach to the current quantum chemistry techniques for molecular studies which holds great promise is the quantum Monte Carlo (QMC) method. With very simple importance functions, we have obtained from 75 to 100% of the correlation energy of two to ten electron molecules (H_2, LiH, Li_2,H_2O). Results are presented for the ground-state energy of Li_2 at a few different nuclear separations.

12969 **(UCID—19932) Discussion of moment method codes with emphasis on aperture coupling.** Grant, J.B. (Lawrence Livermore National Lab., CA (USA)). Nov 1983. Contract W-7405-ENG-48. 16p. NTIS, PC A02/MF A01. Order Number DE84005116.

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In this communication are discussed four numerical codes treating coupling through apertures to wires or other objects. Our intent is to point out advantages and disadvantages of these codes, in which recent interest has been shown. The codes discussed are time harmonic codes utilizing either an electric field integral equation or a reaction integral equation formulation. The four codes examined are: a triangular patch moment method code; a rectangular patch code; a body of revolution moment method code; and a hybrid code which uses both a moment method technique and a finite difference technique. Each code is examined with respect to the geometry of the scatterers for which it can be used. The solution method used, and with respect to various numerical considerations.

12970 **Quantum-classical correspondence for the Fourier spectrum of a trajectory.** Heller, E.J. (Los Alamos National Lab., NM (USA). Theoretical Div.). *Physica D: Nonlinear Phenomena (Amsterdam);* **7**: No. 1-3, 356-361(May 1983).

Also published as report LA-UR--82-2705, 1982.

Using a displaced localized wavepacket (coherent state) as a quantum analog to a classical trajectory, we examine the Fourier spectrum of the expectation value of position Xsub(t)sup(Q), and compare it with the classical Fourier spectrum of position Xsub(t). In both the quasiperiodic and chaotic regimes, a strong classical-quantum correspondence exists in the Fourier spectrum. However, the quantum spectrum has certain interesting features not present in the classical case.

6580 Mathematical Physics

12971 **(SAND—83-1789) Numerical solution for a spinning, nutating, fluid-filled cylinder.** Vaughn, H.R.; Oberkampf, W.L.; Wolfe, W.P. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1983. Contract AC04-76DP00789. 63p. NTIS, PC A04/MF A01. Order Number DE84005878.

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The incompressible, three-dimensional Navier-Stokes equations are solved numerically for a fluid filled cylindrical cannister that is spinning and nutating. The motion of the cannister is characteristic of that experienced by spin stabilized artillery projectiles. Equations for the internal fluid motion are derived in a noninertial, aeroballistic coordinate system. Steady state numerical solutions are obtained by an iterative finite difference procedure. Flow fields and liquid induced moments have been calculated for viscosities in the range of 0.9×10^4 to 1×10^9 centistokes. The calculated moments agree favorably with experimental measurements. These results have direct application to analyzing the flight stability of spinning flight vehicles having highly viscous liquid payloads.

12972 **(SLAC-PUB—3259) Program for a constructive physics.** Noyes, H.P.; Gefwert, C.; Manthey, M.J. (Stanford Linear Accelerator Center, CA (USA); Suomen Akatemia, Helsinki; New Mexico Univ., Albuquerque (USA). Dept. of Computer Science). Nov 1983. Contract AC03-76SF00515. 11p. (CONF-830789—2). NTIS, PC A02/MF A01. Order Number DE84005425.

From 7. congress of logic, methodology and philosophy of science; Salzburg, Austria (11 Jul 1983).

In this paper we outline a program for physics using as basic mathematics counting, binary arithmetic and randomness. We believe this approach makes sense because the discretization of physics has replaced arbitrary continuum standards of time, length and mass by counting the oscillations of an atomic clock, counting the number of wavelengths between two positions and counting the number of atoms in a macroscopic mass. These digital dimensional standards can be used to specify three dimensional constants: the limiting velocity c, the unit of action h, and either a reference mass (eg m/sub p/) or a coupling constant (eg G related to the mass scale by $hc/(2\pi Gm/\text{sub } p^2/) \cong 1.7 \times 10^{38}$). The objective of our program is to provide an algorithmic construction which allows us to relate this connection to specific laboratory paradigms. As in constructive mathematics, we hold that counting must be understood as the practice of mathematics in order to avoid redundancy. We allow no completed infinities and we aim to provide finite algorithms for the computation of any acceptable concept. We do not expect our formalism to be reducible in a mathematical sense to conventional physics. To succeed, our program must lead to an alternative quantitative description of accepted laboratory and experiential phenomena. 18 references.

12973 **(SOL—83-21) Decomposition and scaling-inequality for line-sum-symmetric nonnegative matrices.** Dantzig, G.B.; Eaves, B.C.; Rothblum, U.G. (Stanford Univ., CA (USA). Systems Optimization Lab.). Dec 1983. Contract AT03-76ER72018. 14p. NTIS, PC A02/MF A01. Order Number DE84005639.

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A matrix B is called line-sum-symmetric if it is square and the sum of elements in each row of B equals the sum of elements in the corresponding column. Results from the theory of network flows are used to obtain a decomposition of nonnegative line-sum-symmetric matrices. The decomposition is employed to prove the following inequality: Assume D(x)AD(y) is line-sum-symmetric where A is a square, nonnegative matrix and D(x) and D(y) are diagonal matrices whose diagonal elements are the coordinates of the nonnegative vectors x and y, respectively. Then y/sup T/Ax $\geqq$ x/sup T/Ay.

70 FUSION ENERGY

7001 Plasma Research

12974 **(AD-A—131631/4) Nonlinear force on an unpolarized relativistic test particle to second order in the total field in a nonequilibrium beam-plasma system. Technical report.** Brandt, H.E. (Harry Diamond Labs., Washington, DC (USA)). Aug 1983. 24p. (HDL-TR—1995). NTIS, PC A02/MF A01.

In the theory of electromagnetic radiation processes in nonequilibrium relativistic beam-plasma systems, an important role is played by the time-average nonlinear force acting on a relativistic test particle due to the total electromagnetic field. A major nonlinearity in the field arises from the dependence of the Lorentz force on the particle trajectory, which, in turn, depends on the field. Thereby the force has effectively a nonlinear dependence on the total electromagnetic field. In this document, the time-average of this nonlinear force is derived to second order in the total field for the case of unpolarized and slightly perturbed relativistic particle trajectories. The latter condition is that of applicability of the classical Born approximation for a plasma, namely, that the relativistic particle momentum be much greater than the electromagnetic impulse received by the particle in a time interval given by the inverse plasma frequency. Possible important screening effects arising from test particle polarization are ignored here but will be fully addressed in another report. The result of the present calculation agrees with that of Akopyan and Tsytovich. It is important in calculations of collective radiation and conditions for the occurrence of radiative instability in beam-plasma systems.

12975 **(AD-A—131661/1) Strong coupling effects on bound states in plasmas. Interim progress report No. 2, 1 February 1982-31 January 1983.** Kalman, G.J. (Boston Coll., Chestnut Hill, MA (USA)). Mar 1983. 11p. NTIS, PC A02/MF A01.

Further progress in the areas of (1) kinetics and response of strongly coupled multi-component plasmas, (2) study of plasma phase transition and determination of the degree of ionization of a dense plasma, and (3) generalization of the Thomas-Fermi-Debye-Huckel scheme for strongly coupled plasmas with atoms and ions, is reported: A multi-species formalism has been worked out. Details of the phase transition and of the critical curve have been found. Relationship to other works has been studied.

12976 **(AD-A—131667/8) Boundary-integral simulations of Rayleigh-Taylor instability in ideal magnetohydrodynamics. Final report.** Baker, G.R.; McCrory, R.L.; Orszag, S.A. (Cambridge Hydrodynamics, Inc., MA (USA)). Aug 1983. 36p. NTIS, PC A03/MF A01.

Rayleigh-Taylor fluid instabilities are studied in the ideal magnetohydrodynamic (MHD) limit by applying boundary integral mathematical formulations to solve Laplace's equation with Dirichlet conditions on complicated boundaries. Instabilities in both the flute and sausage modes are studied for an accelerating thin cylindrical plasma, and calculations demonstrate the basic nonlinear dynamics of the z-pinch geometry. The dynamics and mathematics of plane thin shells and thin shells in cylindrical geometries with axisymmetric flow are discussed.

12977 **(AD-A—132109/0) Ponderomotive effects in nonneutral plasmas.** Lamb, B.M.; Morales, G.J. (California Univ., Los Angeles (USA). Center for Plasma Physics and Fusion Engineering). May 1983. 42p. NTIS, PC A03/MF A01.

Nonlinear wave effects in plasmas fall into two broad categories: wave-particle interactions and fluid nonlinearities. For waves whose phase velocities are much larger than the average thermal velocities of all particle species, the wave-particle interaction plays an insignificant role. In such systems the fluid nonlinearities are primarily responsible for the modification of the zero order plasma equilibrium as the wave amplitude is increased beyond the linear regime. The subject of this paper falls into the latter class. Among the numerous fluid nonlinearities associated with a large

amplitude, high frequency, electrostatic wave, there are two effects of overwhelming importance: parametric instabilities and ponderomotive force density modifications. In conventional neutral plasmas both of these can appear simultaneously and lead to interesting physical effects which have been extensively investigated theoretically and experimentally. However, in single species plasmas, i.e., nonneutral plasmas, the parametric instability channel is not readily available because there is only a single mass present. Consequently, in these systems it is expected that the first nonlinear effect to appear is modification of the zero order density by the ponderomotive force. This is the specific issue that is considered in this work.

12978 **(AD-A—132321/1) Observations of nonlinear behavior in a low-pressure discharge column. Progress report for 1983.** Cartier, S.L.; Merlino, R.L. (Iowa Univ., Iowa City (USA). Dept. of Physics and Astronomy). Aug 1983. 31p. NTIS, PC A03/MF A01.

Sudden and abrupt jumps in the plasma density and discharge current of low-pressure magnetized argon and helium plasmas are observed. These jumps are found to depend on the discharge bias voltage, the neutral gas pressure, and the magnetic field strength and occur with a substantial hysteresis in those parameters. These jumps are accompanied by the onset of intense and coherent low-frequency plasma oscillations. In addition, under certain conditions, the radial density profile of the plasma is found to be significantly different following a jump. Some possibly related plasma instabilities are discussed.

12979 **(CEA-CONF—6802) Two dimensionnal beam in a time varying magnetic field. The Brillouin flow as an asymptotic attractor.** Munier, A. (CEA Centre d'Etudes de Limeil, 94 - Villeneuve-Saint-Georges (France)). Jul 1983. 9p. (CONF-8306150—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750431.

From 10. annual plasma physics conference; Bangor, UK (29 Jun 1983).

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The expansion of a one species, two dimensionnal beam immersed into a time varying magnetic field is considered. A length and a time scales are introduced and chosen in such a way that the new system is driven to a stationary steady state through appearance of time independent driving forces and friction terms. It is then conjectured that the only possible steady state will be reached. Computer simulations fully support the hypothesis for a decreasing field slower than t^{-1}.

12980 **(CONF-820980—9) Plasma wave accelerator. II.** Mori, W.; Joshi, C.; Dawson, J.M. (California Univ., Los Angeles (USA). Dept. of Electrical Engineering). 1982. Contract AS08-81DP40163. 4p. NTIS, PC A02/MF A01. Order Number DE84005496.

From European Committee of future accelerators - the challenge of ultra-high energies conference; Oxford, UK (27 Sep 1982).

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It was shown that the insertion of a cross magnetic field prevents the particles from getting out of phase with the electric field of the plasma wave in the beat wave accelerator scheme. Thus, using a CO_2 laser, n/sub c//n/sub e/ = $(\omega_0/\omega/\text{sub p/})^2 \sim 35$, and a 300 kG magnetic field, electrons can be (in principle) accelerated to 100 GeV in 2 meters. For comparison without the magnetic field, the same energies may be obtained in a n/sub c//n/sub e/ ~ 10^5 plasma over a distance of 100 meters.

12981 **(CONF-830822—50) Prospects of the surfatron laser plasma accelerator.** Katsouleas, T.; Joshi, C.; Mori, W.; Dawson, J.M. (California Univ., Los Angeles (USA)). 1983. Contract AS08-81DP40163. 4p. NTIS, PC A02/MF A01. Order Number DE84005463.

From 12. international conference on high energy accelerators; Batavia, IL, USA (11 Aug 1983).

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The surfatron concept is proposed as a possible solution to the problem of staging in the laser-plasma beat wave accelerator scheme. Prospects of a 100 GeV particle accelerator based on the surfatron concept are explored. Finite angle optical mixing appears to be a promising solution for drastically reducing the width of the plane wave, thereby, making the required laser power and the device size realizable for a proof-of-principle experiment. Our conclusions are based mainly on analytical theory and one-dimensional particle simulations.

12982 **(DOE/DP/40163—2) Study of short wavelength turbulence in dense plasmas. Final technical report, September 8, 1981-August 7, 1983.** Chen, F.F.; Joshi, C. (California Univ., Los Angeles (USA). Dept. of Electrical Engineering). Oct 1983. Contract AS08-81DP40163. 13p. NTIS, PC A02/MF A01. Order Number DE84005319.

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The work includes studies of four topics: (1) Thomson scattering from short wavelength density fluctuations from laser excited plasmas from solid targets; (2) studies of SBS driven ion acoustic waves and it's harmonics in underdense plasmas; (3) studies of optical mixing excitation of electron plasma waves (high frequency density fluctuations) in θ pinch plasma; and (4) computational studies of high frequency wave excitation by intense laser beams in plasmas.

12983 **(DOE/ER/53140—12) Monte Carlo study of ICRF start-up and sustained mode operation in tandem mirrors.** Todd, A.M.M. (Grumman Aerospace Corp., Princeton, NJ (USA)). 1983. Contract AC02-82ER53140. 37p. NTIS, PC A03/MF A01. Order Number DE84005808.

A study, using a Monte Carlo simulation code, of ICRF start-up and sustained operation in tandem mirrors by way of ICRF end cell fueling and heating, is described. Although the basic parameter space considered corresponds to the Phaedrus experiment, the central cell density and temperatures are extended towards the reactor regime. It is found that significant end cell potential barriers can be generated with ICRF, but that due to choking of the central cell ion source stream by the barrier, saturation occurs and power requirements rapidly increase, so that density levels are limited to ~ twice the central cell ion temperature. Although performance is improved as the ion cyclotron resonance approaches the end cell midplane, no significant difference is found between inboard, outboard or double resonance location. As the central cell density and temperatures are increased, the RF power requirement is found to increase dramatically. Optimum performance for end cell fueling results when the central cell electron temperature is greater than the ion temperature, but the magnitude of this ratio is limited by an increase in threshold power level with electrom temperature.

12984 **(DOE/ER/53154—61) Neoclassical current studies in high beta plasmas. Technical progress report, October 1, 1982-September 31, 1983.** (Wisconsin Univ., Madison (USA). Plasma Physics Research). 1983. Contract AC02-83ER53154. 74p. NTIS, PC A04/MF A01. Order Number DE84005052.

During the 12-month period, October 1, 1982 to September 30, 1983 the Levitated Octupole has been dedicated to a study of neoclassical currents. At beta values of a few percent, both the Pfirsch-Schlueter current and the bootstrap current have been observed and compared with theoretical predictions. The spatial variation of the current both radially and poloidally are found to agree with the prediction over a wide range of collisionality. A four megawatt ICRH capability exists for sustaining the current in steady state.

12985 **(DOE/ET/51013—93) Sloshing-ion equilibria in the TARA endplugs.** Hokin, S.; Kesner, J. (Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center). Nov 1983. Contract AC02-78ET51013. 26p. (PFC/RR—83-22). NTIS, PC A03/MF A01. Order Number DE84003360.

We have employed a modified version of the LLNL Bounce-average Fokker-Planck code to model neutral beam-produced sloshing-ion equilibria in the TARA endplugs. The questions we have addressed concern the effect of deuterium beam operation as opposed to hydrogen operation, and the advantage of using full-energy beams rather than the usual three-component beams. We find that, for the expected base case TARA operating parameters, a 40% savings in required beam power is attained by using deuterium beams rather than hydrogen beams, and that the use of full-energy beams results in an additional 26% power savings for these param-

eters. For higher plasma temperatures the use of full-energy beams becomes significantly advantagous. We have also investigated the equilibria of two possible alternate mirror configurations for the TARA endplugs, believed to be more stable to trapped particle modes, and report those results here.

12986 **(DOE/ET/51013—T2) Monte Carlo calculation of the pinch and bootstrap neoclassical transport coefficients.** Johnson, J.W. (Massachusetts Inst. of Tech., Cambridge (USA)). Dec 1983. Contract AC02-78ET51013. 100p. NTIS, PC A05/MF A01. Order Number DE84004244.

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The properties of the pinch and bootstrap transport coefficients in axisymmetric systems are investigated using a computer code which integrates the particle guiding center equations. Simple models are developed for the magnetic field and electric field. Two dimensional cubic B-spline interpolation is used to compute the magnetic flux coordinate. Collisions are modeled by a Monte Carlo pitch angle scattering operator. Comparisons to the Lagrangian formulation of neoclassical transport theory are made for both the explicit and the implicit transport coefficients. In the ideal banana regime theory, the explicit and implicit transport coefficients satisfy independent Onsager symmetry relationships. As the scattering frequency is increased, it is predicted that the explicit symmetry relationship should be broken, leaving the trapped particle pinch effect dominant. Also, the implicit processes, which are dominant in the ideal banana limit, should be largely destroyed as the collision frequency is increased.

12987 **(DOE/ET/53052—T1) Development of a high resolution cylindrical crystal spectrometer for line shape and spectral diagnostics of x-rays emitted from - hot - plasmas. Final report, June 1, 1976-December 31, 1983.** Kaellne, E.G. (Smithsonian Institution, Cambridge, MA (USA). Smithsonian Astrophysical Observatory). Jan 1984. Contract AC02-76ET53052. 74p. NTIS, PC A04/MF A01. Order Number DE84005664.

The development, installation and evaluation of a high resolution X-ray spectroscopic diagnostics are reported. The approach has been to optimize spectrometer throughput to enable single shot plasma diagnostics with good time resolution and to ensure sufficient energy resolution to allow line profile analysis. These goals have been achieved using a new X-ray geometry combined with a new position sensitive X-ray detector. These diagnostics have been used at Alcator C to detect X-ray emission of highly ionized impurity elements as well as argon seed elements specially introduced into the plasma for this diagnostic. Temporally resolved ion temperature profiles have been obtained from the recorded X-ray spectra simultaneously with other plasma parameters such as electron temperature, ionization temperature and ionization stage distribution. Radial profiles have also been measured. The developed X-ray diagnostics thus serve as a major multiparameter probe of the central core of the plasma with complementary informtion on radial profiles.

12988 **(DOE/ET/53088—113) Kinetic theory of resistive ballooning modes.** Diamond, P.H.; Similon, P.L.; Hender, T.C.; Carreras, B.A. (Texas Univ., Austin (USA). Inst. for Fusion Studies; Oak Ridge National Lab., TN (USA)). Nov 1983. Contract FG05-80ET53088. 44p. (IFSR—113). NTIS, PC A03/MF A01. Order Number DE84005450.

A linear and nonlinear kinetic theory of resistive ballooning modes that include diamagnetic drifts and finite Larmor radius effects is presented. The linear stability of resistive ballooning modes is examined analytically and numerically. A renormalized resistive ballooning equation is derived, and the saturation level of the instabilities is analytically calculated. Finally, a calculation of the electron thermal conductivity for the large w/sub */ regime is presented.

12989 **(DOE/ET/53088—117) Nonlinear trapped electron response for drift wave turbulence in tokamaks.** Swartz, K.; Diamond, P.H.; Mahajan, S.M.; Hazeltine, R.D. (Texas Univ., Austin (USA)). Nov 1983. Contract FG05-80ET53088. 60p. (IFSR—117). NTIS, PC A06/MF A01. Order Number DE84005385.

The nonlinear trapped electron response to drift wave fluctuations is calculated using the coherent approximation to the DIA in action-angle variables appropriate for toroidal geometry. The bounce-averaged nonlinear response to low frequency electrostatic fluctuations is computed. Employing a spectrum of Pearlstein-Berk structure modes satisfying the symmetry of the ballooning representation, the nonlinear terms are evaluated explicitly. Nonlinear effects do not significantly modify the trapped electron response. Quasineutrality and the nonlinear ion response can then be used in a sheared slab to obtain the turbulence level at saturation level. The level of trapped electron diffusion is calculated.

12990 **(EGG-M—10283) Fusion safety data base.** Laats, E.T.; Hardy, H.A. (EG and G Idaho, Inc., Idaho Falls (USA)). 1983. Contract AC07-76ID01570. 4p. (CONF-831203—79). NTIS, PC A02/MF A01. Order Number DE84005057.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

The purpose of this Fusion Safety Data Base Program is to provide a repository of data for the design and development of safe commercial fusion reactors. The program is sponsored by the United States Department of Energy (DOE), Office of Fusion Energy. The function of the program is to collect, examine, permanently store, and make available the safety data to the entire US magnetic-fusion energy community. The sources of data will include domestic and foreign fusion reactor safety-related research programs. Any participant in the DOE Program may use the Data Base Program from his terminal through user friendly dialog and can view the contents in the form of text, tables, graphs, or system diagrams.

12991 **(EUR-CEA-FC—1176) Exponential separation of neighbouring trajectories in fluid and plasma turbulence.** Misguich, J.H.; Balescu, R. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Recherches sur la Fusion Controlee). Mar 1983. 19p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750414.

The time behaviour of spatial relative diffusion of neighbouring charged particles in turbulent plasmas is shown to have three different time-regimes. An exponential separation of the orbits appears in an intermediate time regime (DUPREE'S clumps). Comparison is performed with analoguous regimes found in Brownian motion, and with fluid turbulence where the exponential regime has recently been observed. From the theoretical point of view, the exponential regime corresponds to a lack of validity of the usual quasi-linear approximation for small initial velocity differences: in this case fluctuations are no longer small corrections, and renormalization appears to be necessary. This gives rise to a SUZUKI scaling regime. The similarity in the results obtained for relative diffusion in plasma and fluid turbulence suggests a further comparison of general processes in these two separate fields.

12992 **(EUR-CEA-FC—1180) Algorithm to solve the linear wave conversion problem in a weakly inhomogeneous plasma.** Gambier, D.J. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Recherches sur la Fusion Controlee). May 1983. 38p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84750412.

In a previous article, we studied the wave equation for electromagnetic and electrostatic waves propagating in a weakly inhomogeneous plasma, assuming a differential equation of the Laplace type. We were able to construct an algorithm, based on the contour integral formalism, which allows to deduct the connection formulae affecting the set of fast propagating waves. Nonetheless the physical problem where a fast wave is exited through an evanescent wave was not tractable using our algorithm, namely it could not give the set of connection formulae affecting non-propagative waves. We, here, extend the method in order to take into account the set of transmission-reflexion coefficients affecting all the waves exited in the vicinity of the conversion layer.

12993 **(EUR-CEA-FC—1181) Group-kinetic theory of turbulent collective collisions.** Tchen, C.M.; Misguich, J.H. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Recherches sur la Fusion Controlee). May 1983. 46p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84750409.

The main objective is the derivation of the kinetic equation of turbulence which has a memory in the turbulent collision integral. We consider the basic pair-interaction, and the interaction between a fluctuation and the organized cluster of other fluctuations in the collection systems, called the multiple interaction. By a group-scaling procedure, a fluctuation is decomposed into three groups to represent the three coupled transport processes of evolution, transport coefficient, and relaxation. The kinetic equation of the scaled singlet distribution is capable of investigating the spectrum of turbulence without the need of the knowledge of the pair distribution. The exact propagator describes the detailed trajectory in the phase space, and is fundamental to the Lagrangian-Eulerian transformation. We calculate the propagator and its scaled groups by means of a probability of retrograde transition. Thus our derivation of the kinetic equation of the distribution involves a parallel development of the kinetic equations of the propagator and the transition probability. In this way, we can avoid the assumptions of independence and normality. Our result shows that the multiple interaction contributes to a shielding and an enchancement of the collision in weak turbulence and strong turbulence, respectively. The weak turbulence is dominated by the wave resonance, and the strong turbulence is dominated by the diffusion.

12994 **(EUR-CEA-FC—1182) Diagrammatic approach to the theory of clumps in turbulent plasmas.** Balescu, R.; Misguich, J.H. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Recherches sur la Fusion Controlee). May 1983. 25p. NTIS (US Sales Only), MF A01. Order Number DE84750410.

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It is shown that much insight is gained by the use of a diagrammatic method in the analysis and classification of both the one-particle fluctuations and the two-particle correlations in a turbulence Vlasov plasma. The various types of renormalization are discussed. The kinetic equation for the average background distribution function is discussed in some detail.

12995 **(EUR-CEA-FC—1186) ICRF heating in T.F.R.** Gambier, D.J. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Recherches sur la Fusion Controlee). Jun 1983. 26p. (CONF-8305127—3). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84750411.

From Spring college on radiation in plasmas; Trieste, Italy (24 May 1983).

Experiments on plasma heating by RF in the ion cyclotron range of frequency have been performed on T.F.R. in various regimes, such as the mode conversion regime and the minority regime. The latest theoretical developments of ICRF modeling are presented and the experimental data obtained in a deuterium plasma containing 20% or 5% of hydrogen are reviewed. With 20% of hydrogen a large increase of both ion and electron temperature is observed while the level of metallic impurity radiation has been considerably reduced using a carbon limiter. With 5% of hydrogen the location of the antenna system in the minor cross section produces no dramatic differences with respect to ion heating. Finally the metallic impurity production is examined and thus allows one to eliminate the Faraday shield of the antenna as the main source of pollution by heavy ions of the plasma.

12996 **(EUR-CEA-FC—1187) Simulation and interpretation codes for the JET ECE diagnostic. Part 1: physics of the codes' operation.** Bartlett, D.V. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Recherches sur la Fusion Controlee). Jun 1983. 77p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE84750413.

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The codes which have been developed for the analysis of electron cyclotron emission measurements in JET are described. Their principal function is to interpret the spectra measured by the diagnostic so as to give the spatial distribution of the electron temperature in the poloidal cross-section. Various systematic effects in the data are corrected using look-up tables generated by an elaborate simulation code. The part of this code responsible for the accurate calculation of single-pass emission and refraction has been written at CNR-Milan and is described in a separate report. The present report is divided into two parts. This first part describes the methods used for the simulation and interpretation of spectra, the physical/mathematical basis of the codes written at CEA-Fontenay and presents some illustrative results.

12997 **(EUR-CEA-FC—1191) Annual report on STGI theoretical work in plasma physics.** (Association Euratom-CEA, Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Recherches sur la Fusion Controlee). 1982. 39p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84750415.

This report presents in a detailed form the theoretical work of the STGI (Service de Theorie des Gaz Ionises). The principal subjects described are plasma equilibrium and evolution, plasma heating, plasma instabilities and turbulence.

12998 **(EUR-CEA-FC—1193) Observation of lower hybrid waves by coherent scattering of microwaves in Wega.** Ichtchenko, G.; O'Connor, W.P.; Moresco, M.; Zilli, E. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Recherches sur la Fusion Controlee). Jul 1983. 94p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750485.

The scattering of 2 mm radiation by the density fluctuation associated with the L.H. waves is used to localize the injected waves within a cross section of the plasma. A translating antenna set-up scans a region extending from the center of the plasma to the boundary with two fixed scattering angles (40° and 70°), each one corresponding to a given perpendicular refractive index (N(perpendicular)=116 and 195 respectively). The measured amplitudes allows one to determine the local value of certain spectral components of N(parallel) in the plasma, if density and temperature profiles are known. The results obtained are interpreted using a ray-tracing technique. The existence of drift waves modulated by the R.F. power is also observed under certain conditions.

12999 **(EUR-CEA-FC—1194) Quasi-linear evolution of tearing modes.** Pellat, R.; Frey, M.; Tagger, M. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Recherches sur la Fusion Controlee). Jul 1983. 19p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750484.

The growth of a Tearing instability in Rutherford's nonlinear regime is investigated. Using a singular perturbation technique, lowest order Rutherford's result is recovered. To the following order it is shown that the mode generates a quasi-linear deformation of the equilibrium flux profile, whose resistive diffusion slows down the growth and shows the possibility of a saturation of the instability.

13000 **(EUR-CEA-FC—1196) Low-Q MHD activity studies on T.F.R.** (Association Euratom-CEA, Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Recherches sur la Fusion Controlee). Aug 1983. 30p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84750483.

T.F.R. has been operated in low q(a) conditions, with a special emphasis on the understanding of the so called current limit. Several schemes have been used, one of the most promising being magnetic surface skinning with a variable toroidal field. Detailed analysis of Mirnov coil and soft X-ray signals is presented and the results discussed. Low q(a) -i.e. high current- discharges have a high poloidal magnetic energy content, which has to be dissipated during the post-disruptive current decrease. The electromagnetic energy balance during this phase is analysed and the dissipation mechanisms identified. Consequences for large tokamaks concerning low-q operation and thermal load associated to major disruptions are deduced.

13001 **(EUR-CEA-FC-RA—1982) 1982 Annual progress report.** (Association Euratom-CEA, Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Recherches sur la Fusion Controlee). Jan 1983. 78p. (In French). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84750416.

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The realization in Cadarache of the big Tokamak with superconducting coils TORE SUPRA is entered in 1982 in the active phase of construction. The most important bargains that have been striken are quoted; the toroidal, cryogenic and poloidal systems have been studied. The experimental programme of TFR Tokamak have been restarted: priority, in physics' programme has been given to ion cyclotron resonance heating. Diagnostics have been, beforehand, improved. "Pellets" injection is studied, and principally electron cyclotron resonance. On Tokamak Petula B totally renovated, studies on heating and creation of current in plasma are restarted by the mean of hybrid resonance waves. Works on ion sources and neutral atom injectors are evocated, so are works on sources and negative beams. Theoretical work are very briefly described in this report.

13002 **(GA-A—16240) Stochastic current drive by lower hybrid waves.** Matsuda, K. (General Atomic Co., San Diego, CA (USA)). Feb 1981. Contract AT03-76ET51011. 6p. (CONF-810214—16). NTIS, PC A02/MF A01. Order Number DE84005384.

From 4. topical conference on radio frequency plasma heating; Austin, TX, USA (9 Feb 1981).

It is well known that if waves in the lower hybrid frequency range are launched by a finite-size source, they are confined in well-defined propagation cones as they penetrate into the plasma. On the other hand, previous theoretical studies of lower hybrid current drive assumed that waves are uniformly distributed in the direction parallel to the magnetic field and transfer their momentum via quasilinear Landau damping. Although this assumption is justified for waves with small amplitudes, it might not be appropriate for a high-powered operation such as in reactor applications. In this report, we show that if a traveling wave with an appropriate phase velocity is confined in a finite region of a periodic system and its amplitude is above a critical value, large currents carried by a large number of electrons result. The mechanism of this momentum transfer is a stochastic phenomenon similar to Fermi's oscillating wall problem with a potential wall with fine structure. We study the phenomenon first by a one-dimensional single particle model, then confirm it by a two-and-a-half-dimensional particle simulation.

13003 **(GA-A—16250) Electron runaway induced by lower hybrid waves in DII-A.** Harvey, R.W.; Riordan, J.C.; Luxon, J.L.; Marx, K.D. (General Atomic Co., San Diego, CA (USA)). Feb 1981. Contract AT03-76ET51011. 7p. NTIS, PC A02/MF A01. Order Number DE84005386.

In the DII-A lower hybrid heating experiment, injection of power using the lowest n/sub parallel to/ antennas resulted in marked increases in plasma conductivity, hard and soft x-rays, and cyclotron radiation. The magnitudes of these increases vary inversely with n/sub e/ and n/sub parallel to/, whereas bulk electron heating was not observed at low n/sub parallel to/. These observations are interpreted as due to an RF-induced electron runaway in the DC electric field.

13004 **(LBL—16145) Design and fabrication of a 30 second pulsed plasma generator.** Biagi, L.A.; Ehlers, K.W.; Lietzke, A.F.; Matuk, C.A.; Maruyama, Y.; Paterson, J.A.; Tanabe, J.T. (Lawrence Berkeley Lab., CA (USA)). Oct 1983. Contract AC03-76SF00098. 16p. (CONF-831011—5). NTIS, PC A02/MF A01. Order Number DE84005184.

From American Vacuum Society symposium; Boston, MA, USA (31 Oct 1983).

The design and fabrication techniques for a large hybrid magnetic cusp plasma generator developed for 30 sec pulse length are described. Included are the magnetic cusp geometry features, water cooling characteristics, filament structures, and the high energy density actively cooled anode and electron dump employed.

13005 **(PPPL—2059) Multiple time scale methods in tokamak magnetohydrodynamics.** Jardin, S.C. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Jan 1984. Contract AC02-76CH03073. 81p. NTIS, PC A05/MF A01. Order Number DE84006283.

Several methods are discussed for integrating the magnetohydrodynamic (MHD) equations in tokamak systems on other than the fastest time scale. The dynamical grid method for simulating ideal MHD instabilities utilizes a natural nonorthogonal time-dependent coordinate transformation based on the magnetic field lines. The coordinate transformation is chosen to be free of the fast time scale motion itself, and to yield a relatively simple scalar equation for the total pressure, $P = p + B^2/2\mu_0$, which can be integrated implicitly to average over the fast time scale oscillations. Two methods are described for the resistive time scale. The zero-mass method uses a reduced set of two-fluid transport equations obtained by expanding in the inverse magnetic Reynolds number, and in the small ratio of perpendicular to parallel mobilities and thermal conductivities. The momentum equation becomes a constraint equation that forces the pressure and magnetic fields and currents to remain in force balance equilibrium as they evolve. The large mass method artificially scales up the ion mass and viscosity, thereby reducing the severe time scale disparity between wavelike and diffusionlike phenomena, but not changing the resistive time scale behavior. Other methods addressing the intermediate time scales are discussed.

13006 **(PPPL—2061) Initial results from the scoop limiter experiment in PDX.** Budny, R.; Bell, M.; Bol, K.; Boyd, D.; Buchenauer, D.; Cavallo, A.; Couture, P.; Crowley, T.; Darrow, D.; Dylla, F. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Dec 1983. Contract AC02-76CH03073. 32p. NTIS, PC A03/MF A01. Order Number DE84006285.

A particle scoop limiter with a graphite face backed by a 50 liter volume for collecting particles was used in PDX. Experiments were performed to test its particle control and power handling capabilities with up to 5 MW of D^0 power injected into D^+ plasmas. Line average plasma densities up to 8×10^{13} cm^{-3} and currents up to 450 kA were obtained. Plasma densities in the scoop channels greater than 2×10^{13} cm^{-3} and neutral densities in the scoop volume greater than 5×10^{14} cm^{-3} were observed. There is evidence that recycling may have occurred in the scoop channels for several discharges with large line-averaged plasma density. At beam powers up to 2.5 MW, energy confinement times above 40 ms were deduced from magnetics measurements and from transport analysis. Pressures in the vacuum vessel were in the 10^{-5} Torr range, and recycling source neutral densities in the central plasma were low.

13007 **(PPPL—2063) Ion transport studies on the PLT tokamak during neutral beam injection.** Suckewer, S.; Cavallo, A.; Cohen, S.; Daughney, C.; Denne, B.; Hinnov, E.; Hosea, J.; Hulse, R.; Hwang, D.; Schilling, G. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Dec 1983. Contract AC02-76CH03073. 40p. NTIS, PC A03/MF A01. Order Number DE84006279.

Radial transport of ions during co- and counter-neutral beam heating in the PLT tokamak has been studied, using molybdenum and scandium ions as tracer elements. The time evolution of the radial profiles of several ionization stages of both elements, injected by laser blowoff during the neutral beam heating, were measured under three significantly different beam-plasma combinations. No noticeable differences in the radial profiles attributable to the beam direction were observed. However, a given injected amount resulted in considerably larger interior concentrations of the tracer element in the counter-beam heating cases, suggesting larger penetration of the plasma periphery. Computer simulation with the MIST code suggests a net inward drift of the order 10^3 cm/sec superposed to a diffusion coefficient of the order 10^4 cm^2/sec for both scandium and molybdenum ions. Injection of larger amounts of the tracer element, sufficient to cause measurable central electron temperature changes, resulted in dramatic changes in ion-state distributions, making some appear peaked in the center while others disappeared. This effect could be produced with both co- and counter-beam heating, but with lesser amounts in the latter case. It is inter-

preted as rearrangement of the ionization balance, rather than any preferential accumulation of the injected element.

13008 **(PPPL—2068) He^{++} transport in the PDX tokamak.** Fonck, R.J.; Hulse, R.A. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Dec 1983. Contract AC02-76CH03073. 14p. NTIS, PC A02/MF A01. Order Number DE84006284.

A powerful new approach to the study of particle transport and helium ash confinement in high-temperature fusion plasmas is demonstrated by charge-exchange recombination spectroscopy of He^{++} in ohmically heated PDX discharges. Time and space resolved measurements of He^{++} density following a short puff of helium gas into the plasma edge are fitted using a diffusive/convective transport model with coefficients $D = (2.1 +- 0.9) \times 10^4$ cm^2 s^{-1} and v(r)/D = (0.8 +- 0.3) δ (ln n/sub e/)/δr.

13009 **(PPPL—2070) Fast time resolution charge-exchange measurements during the fishbone instability in the poloidal divertor experiment.** Beiersdorfer, P.; Kaita, R.; Goldston, R.J. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Jan 1984. Contract AC02-76CH03073. 21p. NTIS, PC A02/MF A01. Order Number DE84006278.

Measurements of fast ion losses due to the fishbone instability during high β/sub T/q neutral beam heated discharges in the Poloidal Divertor Experiment have been made using two new vertical-viewing charge-exchange analyzers. The measurements show that the instability has an n=1 toroidal mode number, and that it ejects beam ions in a toroidally rotating beacon directed outward along a major radius. Observations of ejected ions with energies up to twice the beam injection energy at $R \approx R_0 +$ a indicate the presence of a non-μ-conserving acceleration mechanism.

13010 **Measurements of plasma density profiles driven by p-polarized microwaves.** Spielman, R.B.; Mizuno, K.; Woo, W.; DeGroot, J.S. (California Univ., Davis (USA). Dept. of Applied Science). *Physics Letters [Section] A;* **96**: No. 6, 289-291(11 Jul 1983).

For supersonic plasma flow velocities, instead of the usual shelf-step profile seen for subsonic flow, an overdense bump and cavity is observed. The profile is stable for long times even for moderate power microwaves.

13011 **Energy of the thermal electrons in electron beam created helium discharges.** Yu, Z.; Rocca, J.J.; Collins, G.J. (Colorado State Univ., Fort Collins (USA). Dept. of Electrical Engineering); She, C.Y. (Colorado State Univ., Fort Collins (USA). Dept. of Physics). *Physics Letters [Section] A;* **96**: No. 3, 125-129(20 Jun 1983).

We have measured the electron energy of the thermal group of electrons in both longitudinal and transverse electron beam created helium glow discharges. The measurement technique employs the ratio of intensities of spectral lines in the $2s^3S$-np^3P He I series. Values of kTsub(e) between 0.07 and 0.11 eV were obtained. These energies are typical of the beam-generated electric field free plasmas. The competitive loss of helium ions by recombination and by charge transfer in a He-Hg electron beam created plasma is calculated. The results are applied to the Hg^+ laser pumping scheme using an electron beam created He-Hg plasma.

13012 **Neutronic calculations for the Tokamak fusion test reactor diagnostic penetrations.** Kolibal, J.G. (Princeton University, Plasma Physics Laboratory, Princeton, NJ). *Nuclear Technology/Fusion;* **2**: No. 2, 313-324(Apr 1982). Contract AC02-76CH03073.

The arrangement of the tokamak fusion test reactor diagnostic system results in a number of streaming paths that are directly visible to the plasma. Two important configurations of these penetrations have been examined: the large isolated ducts through the primary igloo shield at the plasma midplane, and the coplaner diagnostic tubes through the substructure beneath the plasma. The spatial distribution of the flux and spectrum has been determined as preliminary input for the design of the diagnostic shield boxes.

7002 Fusion Power Plant Technology

REFER ALSO TO CITATION(S) 11868, 11929, 12392, 12457, 12556, 12955

13013 **(CEA-CONF—6812) Shielding design of the tokamak TORE SUPRA.** Diop, C.; Brandicourt, G.; Ermont, G.; Nimal, J.C.; Chatelier, M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France); CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). May 1983. 9p. (CONF-830538—20). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750435.

From 6. international conference on radiation shielding; Tokyo, Japan (16 May 1983).

In this paper it is shown how the radiation shielding problems, connected with the Tokamak TORE SUPRA, are solved. Two general topics are approached: shielding parameters such as thicknesses, activation of design structures. The neutron and gamma dose rate calculations are described. The significant results of these studies are given.

13014 **(CEA-CONF—6847) Solid breeder blanket concepts.** Chevereau, G. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Jun 1983. 4p. (CONF-8306152—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750439.

From Workshop on fusion blanket technology; Erice, Italy (6 Jun 1983).

An investigation is made of a mechanical concept for the blanket with solid breeders in view of the possible adaptation to power reactor. A special arrangement of the multiplier and breeder materials is developed to permit a further neutronic optimisation.

13015 **(CEA-CONF—6848) Fusion reactor blanket neutronic studies in France.** Barre, F.; Gervaise, L.; Giancarli, L. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Jun 1983. 6p. (CONF-8306152—2). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750458.

From Workshop on fusion blanket technology; Erice, Italy (6 Jun 1983).

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The problem of effective tritium regeneration is crucial issue for the fusion reactor, especially for the power reactor because of the conflicting requirements of heat removal and tritium breeding. For that, calculations are performed to evaluate blanket materials. Precise techniques are herein developed to improve the accuracy of the tritium production and the neutron and gamma transport calculations. Many configurations are studied with realistic breeder, structure, and coolant proportions. Accuracy of the results are evaluated from the sensitivity theory and uncertainty analysis. The results of these studies permit to conclude that it is possible to expect an adequate tritium breeding ratio.

13016 **(CONF-811040—206) Two-phase helium-IV quench analysis for superconducting magnets.** Byington, G.A.; Shipley, W.D.; Ryan, T.L. (Union Carbide Corp., Oak Ridge, TN (USA). Nuclear Div.). 1981. Contract W-7405-ENG-26. 5p. NTIS, PC A02/MF A01. Order Number DE84004454.

From 9. symposium on engineering problems of fusion research; Chicago, IL, USA (26 Oct 1981).

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The sizing of a coil venting system to ensure that the coil cavity design pressure is not exceeded during a quench is a critical part of any superconducting coil design. This paper describes the calculations performed by this computer program to analyze the two-phase venting of the helium coolant during a superconducting coil quench. The coils being analyzed are a pool boiling, superconducting magnet for the Large Coil Program.

13017 **(CONF-831203—70) Engineering considerations in the selection of the tokamak to follow the Tokamak Fusion Test Reactor (TFTR).** Shannon, T.E. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 5p. NTIS, PC A02/MF A01. Order Number DE84004441.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

The tokamak to follow the Tokamak Fusion Test Reactor (TFTR) should satisfy two important objectives. First, it should be a significant step in physics and engineering goals in order to maintain the level of progress which the US has established as the world leader in fusion energy development. The second objective should be to provide the information necessary to support the strategy and goals of the long-range Department of Energy (DOE) Fusion Program. In their Comprehensive Program Management Plan, the DOE identifies the need for a reactor technology program in the 1990s in which the major goal is to prove engineering feasibility. In this paper, the specific engineering needs are identified which have been developed through the tokamak design studies over the past decade. On the basis of these needs, it appears that several options are available for the next tokamak to follow TFTR. The final choice of the concept will involve consideration of the technical needs and the reality of the Fusion Program budget.

13018 **(CONF-831203—85) Fabrication of ion source components by electroforming.** Schechter, D.E.; Sluss, F. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 5p. NTIS, PC A02/MF A01. Order Number DE84004693.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

Several components of the Oak Ridge National Laboratory (ORNL)/Magnetic Fusion Test Facility (MFTF-B) ion source have been fabricated utilizing an electroforming process. A procedure has been developed for enclosing coolant passages in copper components by electrodepositing a thick ($\geq$ 0.75-mm) layer of copper (electroforming) over the top of grooves machined into the copper component base. Details of the procedure to fabricate acceleration grids and other ion source components are presented.

13019 **(CONF-831203—87) Recent progress in the First Wall/Blanket/Shield Program.** Nygren, R.E. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 6p. NTIS, PC A02/MF A01. Order Number DE84005211.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

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The results from the First Wall/Blanket/Shield Program during FY 1982 and FY 1983 are reviewed. Major accomplishments include: e-beam surface heating tests and simulations of melting and vaporization during plasma disruptions, preparation and operation of a 100 kW e-beam facility (ASURF) for surface heating tests, isothermal simulations of Li_2O subjected to helium construction of an electromagnetic test stand (FELIX) and progress in development of eddy current codes, experimental results on electrical contacts capable of carry high currents for sector-to-sector shunts in tokamaks, designs for large remotely-actuated mechanical joints and completion of the first edition of the Designers' Guidebook on Remote Assembly, Maintenance and Repair. The program has recently focused on a narrower scope of critical issues in blanket technology. Current activities in the (renamed) Blanket Technology Program are also briefly reviewed.

13020 **(CONF-831203—88) Tritium systems for the tokamak fusion core experiment, TFCX.** Finn, P.A. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 6p. NTIS, PC A02/MF A01. Order Number DE84005212.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

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Tritium systems, tritium needs and possible tritium release scenarios were assessed for a TFCX class of device, 250 MW, 2 x 10^8 s of burn, with burn times from 20 s to 300 s. On-site and off-site, continuous and batch processing modes were considered. A reference case, batch processing was developed which fulfills the requirements for plasma physics experiments.

13021 **(CONF-831203—89) Tritium systems for the mirror upgrade MFTF-α+T.** Finn, P.A. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 6p. NTIS, PC A02/MF A01. Order Number DE84005215.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

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The tritium systems and the tritium needed for MFTF-α+T were assessed. This mirror reactor produces 20 MW of power, has 10% availability, and uses tritium positive neutral beams with 20 to 30% total gas efficiency as fuelers. The two burn times considered were 10 h and 100 h. A reference processing case was developed including types, sizes, and cost of units.

13022 **(CONF-831203—90) Electromagnetic analysis for fusion reactors: status and needs.** Turner, L.R. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 6p. NTIS, PC A02/MF A01. Order Number DE84005214.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

Electromagnetic effects have far-reaching implications for the design, operation, and maintenance of future fusion reactors. Two-dimensional (2-D) eddy current computer codes are available, but are of limited value in analyzing reactors. Three-dimensional (3-D) codes are needed, but are only beginning to be developed. Both 2-D and 3-D codes need verification against experimental data, such as that provided by the upcoming FELIX experiments. Coupling between eddy currents and deflections has application in fusion reactor design and is being studied both by analysis and experiment.

13023 **(CONF-831203—92) Burn cycle requirements comparison of pulsed and steady-state tokamak reactors.** Brooks, J.N.; Ehst, D.A. (Argonne National Lab., IL (USA)). Dec 1983. Contract W-31-109-ENG-38. 8p. NTIS, PC A02/MF A01. Order Number DE84005263.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

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Burn cycle parameters and energy transfer system requirements were analyzed for an 8-m commercial tokamak reactor using four types of cycles: conventional, hybrid, internal transformer, and steady state. Not surprisingly, steady state is the best burn mode if it can be achieved. The hybrid cycle is a promising alternative to the conventional. In contrast, the internal transformer cycle does not appear attractive for the size tokamak in question.

13024 **(CONF-831203—93) Assessment of thermal storage systems and thermomechanical effects for pulsed reactors.** Misra, B.; Stevens, H.; Majumdar, S.; Ehst, D. (Argonne National Lab., IL (USA)). Dec 1983. Contract W-31-109-ENG-38. 6p. NTIS, PC A02/MF A01. Order Number DE84005264.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

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Pulsed operation of fusion power plants has severe impact on all major reactor components. This analysis focuses on the sensitivity of one subsystem, the breeding blanket, to pulsed operation in terms of thermal storage requirements and thermomechanical effects. For analysis, a water-cooled Li_2O breeding blanket (400 MWth, 3.45 MW/m^2 neutron wall loading) was chosen. With the operating temperature window, 800/410°C for Li_2O, thermal analysis shows that for the coolant-in-tube design (STARFIRE) there would be 10 rows of coolant tubes in the radial direction of the blanket. Since the thermal inertia of the blanket is larger further away from the first wall, the mixed mean temperature of coolant from all regions will dictate the design requirements for the thermal storage system. Three representative blanket regions were analyzed under four burn scenarios (startup/shutdown time = 10 s, steady-state time = 3600 s, and dwell time = 0, 30, 90, and 200 s) to estimate the thermal storage requirements. The size of the thermal storage system is dictated primarily by the energy deficiency that occurs during the dwell/startup and shutdown phase, although time/temperature response of the heat transfer fluid is critical to the design. Only pressurized water/steam and hot sodium thermal stor-

age systems are considered for this study, since alternative systems are not attractive for heat storage of the order of 11 MWh to 230 MWh.

13025 **(CONF-831203—94) First wall and limiter lifetime in pulsed tokamak reactors.** Ehst, D.; Majumdar, S.; Cha, Y.; Hassanein, A. (Argonne National Lab., IL (USA)). Dec 1983. Contract W-31-109-ENG-38. 6p. NTIS, PC A02/MF A01. Order Number DE84005262.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

This study concentrates on the structural integrity of certain reactor subsystems under cyclic operation to answer the question: how long a burn pulse is needed to achieve the benefits of steady-state operation. Component lifetime in the steady-state is limited by three effects: radiation damage, disruptions, and sputtering erosion. Cyclic operation modifies one of these (the number of disruptions may increase with the number of burn cycles) and introduces a fourth life limit, thermal fatigue. Our design strategy is to determine the structure and coating thicknesses which maximize component lifetime against all life limitations. After calculating disruption damage (vaporization, melting) for candidate materials we present the lifetime analysis for different structures.

13026 **(CONF-831203—95) Magnet design approach for pulsed tokamak reactors.** Kim, S.H.; Evans, K. Jr.; Ehst, D.A. (Argonne National Lab., IL (USA)). Dec 1983. Contract W-31-109-ENG-38. 6p. NTIS, PC A02/MF A01. Order Number DE84005261.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

A choice of various operating modes of a tokamak reactor will have considerable impact on the fatigue lives and cost of ohmic heating (OH), equilibrium field (EF), and toroidal field (TF) coils. OH AND EF coil requirements and their costs, as well as the effects of the fringing fields of the EF coils on the TF coils, have been studied under cyclic operation in the range of $N = 10^3$ to 10^6 cycles, spanning the range from a noninductively driven reactor (STARFIRE) to a conventional ohmically driven reactor. For a reference design of TF coils the design of the central OH solenoid has been studied as a function of its maximum field, B/sup OH/. Increasing requirements for structural support lead to only negligible increases in volt-seconds for B/sup OH/ $\geqq$ 10.0 T. Fatigue failure of the OH coil is not a concern for $N \leqq 10^5$; for $N \sim 10^6$ fatigue limits the strain to small values, resulting in small increases in structural requirements and modest decreases in volt-seconds. Should noninductive current drive be achievable we note that this not only eliminates the OH coil, but it also permits EF coil placement in the inboard region, which facilitates the creation of highly shaped plasma cross sections (large triangularity, or bean-shaped equilibria). We have computed the stored energy, coil configuration and fringing fields for a number of EF coil design options.

13027 **(CONF-831260—1) Joint European Torus (JET) project.** Sheffield, J. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 28p. NTIS, PC AMF A01. Order Number DE84004645.

From Workshop on international cooperation in magnetic fusion; Washington, DC, USA (14 Dec 1983).

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This paper reviews the historical development of the JET tokamak. (MOW)

13028 **(CONF-8209153—) Proceedings of the second meeting on electrical insulators for fusion magnets.** (USDOE Office of Energy Research, Washington, DC. Office of Fusion Energy). Jul 1983. 213p. NTIS, PC A10/MF A01. Order Number DE83017540.

From 2. meeting on electrical insulators for fusion magnets; Germantown, MD, USA (8 Sep 1982).

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To guide the formulation of this program, nineteen speakers generally representing the magnet community - manufacturers, designers, and materials people - met and presented a series of talks in six sessions. Sessions topics included: magnet insulator environment, current testing activities, irradiation sources, failure modes, test parameters, and insulator design. Each presentation was discussed by the meeting, at-large, and the concensus opinions of these discussions were noted. After the conclusion of the talks, the meeting was subdivided into four subcommittees to consider and make recommendations on the following topics: irradiation facilities and dosimetry, insulator compositions and specimen sizes and shapes, test procedures and equipment, and specimen loads, influence of magnet mechanical and thermal cycles on test program, and international cooperation.

13029 **(DOE/ER—0113/2, pp 1-18) Property studies of solid tritium breeding materials.** Johnson, C.E. (Argonne National Lab., IL); Kurasawa, T.; Maroni, V.A.; Shearer, J.A.; Tam, S.W.; Tetenbaum, M. Oct 1983. NTIS, PC A07/MF A01.

In Special-purpose materials for magnetically confined fusion reactors. Fifth annual progress report.

The objective of this work is to evaluate the potential of solid lithium-containing ceramic materials as tritium breeding materials for D-T fusion reactors. This activity includes: (1) experimental studies on candidate solid breeder materials with regard to measurement of relevant chemical and physical properties and tritium release characteristics; and (2) the analysis and review of physicochemical and mechanical properties data to determine system operating limits.

13030 **(DOE/ET/51013—105) Protection of toroidal field coils using multiple circuits.** Thome, R.J.; Tarrh, J.M.; Pillsbury, R.D. Jr.; Mann, W.R.; Langton, W.G. (Massachusetts Inst. of Tech., Cambridge (USA)). 1983. Contract AC02-78ET51013. 15p. (PFC/CP—83-14; CONF-831203—76). NTIS, PC A02/MF A01. Order Number DE84005076.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

The protection of toroidal field (TF) coils using multiple circuits is described. The discharge of a single-circuit TF system is given for purposes of definition. Two-circuit TF systems are analyzed and the results presented analytically and graphically. Induced currents, maximum discharge voltages, and discharge time constants are compared to the single-circuit system. Three-circuit TF systems are analyzed. In addition to induced currents, maximum discharge voltages, and time constants, several different discharge scenarios are included. The impacts of having discharge rates versus final maximum coil temperatures as requirements are examined. The out-of-plane forces which occur in the three-circuit TF systems is briefly described and results for a Toroidal Fusion Core Experiment (TFCX) scale device are given based on computer analysis. The advantages and disadvantages of using multiple-circuit systems are summarized and discussed. The primary disadvantages of multiple circuits are the increased circuit complexity and potential for out-of-plane forces. These are offset by the substantial reduction in maximum discharge voltages, as well as other design options which become available when using multiple circuits.

13031 **(DOE/ET/51013—107) Aspects of long pulse commercial tokamak reactor design.** LeClaire, R.J.; Meyer, J.E.; Bromberg, L.; Cohn, D.R.; Williams, J.E.C. (Massachusetts Inst. of Tech., Cambridge (USA)). Dec 1983. Contract AC02-78ET51013. 28p. (CONF-831203—77). NTIS, PC A03/MF A01. Order Number DE84004816.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

Illustrative design parameters have been developed for an Ultra-Long Pulse Tokamak Reactor (ULTR) with a pulse length of 24 hours. The principles developed for the 24 hour pulse length ULTR design have also been used in a scoping study for machines with shorter pulses. Parameters for a machine with a 4 hour pulse length are given. The ULTR design has an ohmic transformer which is optimized to satisfy the conflicting requirements of maximized OH drive and for reaction of the inward forces of the TF coil. The toroidal field magnet is completely modularized, with each coil in its own cryostat and shearing panels at room temperature. Analysis of effects of thermal fatigue on a representative first wall design has been performed. Windows of allowed operation have been found, limited by primary stress, swelling and fatigue.

The analysis has been carried out for first walls made of stainless steel or vanadium.

13032 **(EGG-M—10883) Mobile reactor concepts as applied to testing of compact fusion reactors.** Masson, L.S.; Watts, K.D. (EG and G Idaho, Inc., Idaho Falls (USA)). 1983. Contract AC07-76ID01570. 6p. (CONF-831203—81). NTIS, PC A02/MF A01. Order Number DE84004542.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

Compact fusion reactor concepts have recently received increased emphasis because of advantages principally related to their low cost and short development time. Physics experiments are underway and test results are sufficiently encouraging to merit consideration of ignition-type experiments. Since experiments of this nature involve radioactivity, the requirement for test facilities which incorporate remote handling capabilities becomes apparent. One approach to a test facility concept which has particularly attractive features is based on the mobile test reactor concept employing facilities such as are found at the Idaho National Engineering Laboratory (INEL). The mobile reactor test concept was developed in the 1950s and was used extensively in the testing of aircraft nuclear propulsion reactors at the INEL. In this instance, test reactors were assembled on a dolly and were transported to and from test facilities on a four-rail track system. Nuclear operations were conducted from heavily shielded underground control rooms and, for major maintenance operations, the reactors were unplugged and returned to a large, centrally located hot shop. A similar concept is envisioned for compact fusion reactor testing.

13033 **(EGG-M—10983) Fusion technology development: role of fusion facility upgrades and fission test reactors.** Hsu, P.Y.; Deis, G.A.; Miller, L.G.; Longhurst, G.R.; Schmunk, R.E. (EG and G Idaho, Inc., Idaho Falls (USA)). 1983. Contract AC07-76ID01570. 8p. (CONF-831203—80). NTIS, PC A02/MF A01. Order Number DE84005056.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

The near term national fusion program is unlikely to follow the aggressive logic of the Fusion Engineering Act of 1980. Faced with level budgets, a large, new fusion facility with an engineering thrust is unlikely in the near future. Within the fusion community the idea of upgrading the existing machines (TFTR, MFTF-B) is being considered to partially mitigate the lack of a design data base to ready the nation to launch an aggressive, mission-oriented fusion program with the goal of power production. This paper examines the cost/benefit issues of using fusion upgrades to develop the technology data base which will be required to support the design and construction of the next generation of fusion machines. The extent of usefulness of the nation's fission test reactors will be examined vis-a-vis the mission of the fusion upgrades. We will show that while fission neutrons will provide a useful test environment in terms of bulk heating and tritium breeding on a submodule scale, they can play only a supporting role in designing the integrated whole modules and systems to be used in a nuclear fusion machine.

13034 **(GA-A—16874) Low activation design study. Annual report for fiscal year 1982, March 1, 1981-September 30, 1982.** (GA Technologies, Inc., San Diego, CA (USA)). Nov 1982. Contract AT03-76ET51011. 86p. NTIS, PC A05/MF A01. Order Number DE84005332.

A program has been under way for two years with DOE sponsorship to provide some early assessments of design and performance questions with low activation materials. The approach taken was to select the STAR-FIRE tokamak reactor design as a reference and then to perform an iteration by substituting low activation materials for the design of each component subjected to significant neutron exposure and hence activation. All of the functional requirements and general envelope of each component in the STAR-FIRE system were preserved. Components and their construction materials were studied for limiters, first wall, blankets, shielding, and magnet coils.

13035 **(LBL—16865) Effects of cesium in the plasma of the surface conversion H^- source.** Ehlers, K.W.; Leung, K.N. (Lawrence Berkeley Lab., CA (USA)). Oct 1983. Contract AC03-76SF00098. 12p. (CONF-831180—17). NTIS, PC A02/MF A01. Order Number DE84003388.

From 3. international symposium on the production and neutralization of negative ions and beams; Upton, NY, USA (14 Nov 1983).

The usual method for replacing the partial monolayer of cesium which is removed by sputtering from the surface of the converter electrode of a surface production negative ion source, is to allow cesium atoms to condense or adsorb onto this surface. While this method is easily employed for short pulsed source operation, it becomes increasingly difficult in the dc case because of the high probability of ionization of the cesium atoms as they pass through the discharge. In this paper, we attempt to analyze the severity of this problem in which cesium arrives at the converter surface as an energetic ion rather than as a thermal atom.

13036 **(PB—83-263525) Toshiba review. Volume 38, Number 9, 1983.** (Toshibe Corp., Tokyo (Japan). Principal Office). 1983. 98p. NTIS, PC E05/MF E01.

Contents: Nuclear fusion about to great new stage; Present status of fusion development; Conceptual designs of Tokamac reactor and RandD; Fusion experimental devices; Neutral beam injector; Radio frequency devices for plasma heating; Superconducting magnet system; Power supply and control equipment for nuclear fusion; Instrumentation for nuclear fusion devices; Fusion reactor neutronics; Telephone speech recognition; Digital electronic private branch exchange; Plain paper copier, Leodry 7811; Diagnostic X-ray generator; Characterization of silicon wafers for VLSI; Residual-current-operated current breaker with multifunction; Audio-video color TV receiver, CORE FS; Transient thermal performance of encapsulated latent-heat storage unit; Direct-cooling automatic-defrost freezer-refrigerator.

13037 **(PPPL—2057) Gas fueling studies in the PDX tokamak: II.** Dylla, H.F.; Bell, M.G.; Fonck, R.J.; Jaehnig, K.; Kaye, S.M.; Owens, D.K.; Heifetz, D.B.; Schmidt, G.L. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Jan 1984. Contract AC02-76CH03073. 20p. (CONF-830795—9). NTIS, PC A02/MF A01. Order Number DE84006282.

From Symposium on energy removal and particle control and toroidal fusion devices; Princeton, NJ, USA (26 Jul 1983).

Measurements of the gas fueling characteristics of the PDX tokamak have been extended in parameter range. An earlier study presented the gas fueling efficiency for H_2 and D_2 for the standard PDX divertor configurations with a large conductance between the divertor and main plasma chambers. This study presents the observed variations in H_2, D_2, and He neutral pressure and ionization light emission for divertor configurations with a restricted conductance between the divertor and main plasma chambers. The restricted conductance improved the divertor/main-chamber compression ratio by more than an order of magnitude. For the same plasma density, gas fueling from the divertor chamber was twice as efficient as fueling from the main chamber. At the highest plasma densities that were investigated, anti n/sub e/ $\approx 4 \times 10^{13}$ cm^{-3}, a decrease in the plasma temperature in the divertor was indicated by a decrease in the ionization light at the divertor throat for D_2 and He fueled discharges. These observations are consistent with a Monte-Carlo model of neutral gas transport in the divertor.

13038 **(PPPL—2074) Requirements for negative ion based systems from users' point of view.** Stewart, L.D. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Jan 1984. Contract AC02-76CH03073. 12p. NTIS, PC A02/MF A01. Order Number DE84006277.

This paper reviews the projected requirements of tokamak and mirror confinement devices for negative ion based neutral beam systems. The physics bases for the requirements are reviewed; the stated requirements are summarized for various mirror and tokamak devices, including MFTF-α+T, MARS, FED-A, and FED-R; and changes in those stated requirements, based on improved calculations of beam-stopping cross sections, are estimated.

13039 **(PPPL-EPRI—11) Tritium recovery from lithium oxide pellets.** Bertone, P.C.; Jassby, D.L. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Jan 1984. Contract AC02-76CH03073. 20p. NTIS, PC A02/MF A01. Order Number DE84006280.

The TFTR Lithium Blanket Module is an assembly containing 650 kg of lithium oxide that will be used to test the ability of neutronics codes to model the tritium breeding characteristics of limited-coverage breeding zones in a tokamak. It is required that tritium concentrations as low as 0.1 nCi/g bred in both metallic lithium samples and lithium oxide pellets be measured with an uncertainty not exceeding +- 6%. A tritium assay technique for the metallic samples which meets this criterion has been developed. Two assay techniques for the lithium oxide pellets are being investigated. In one, the pellets are heated in a flowing stream of hydrogen, while in the other, the pellets are dissolved in 12 M hydrochloric acid.

13040 **(SAND—83-1493C) Flexible automated waveform recorder data acquisition program.** Boyer, W.B. (Sandia National Labs., Albuquerque, NM (USA)). 17 Jan 1984. Contract AC04-76DP00789. 24p. (CONF-840115—1). NTIS, PC A02/MF A01. Order Number DE84005553.

From Instrumentation and measurement technology conference; Long Beach, CA, USA (17 Jan 1984).

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Software has been developed to record signals in automated data acquisition systems that support pulsed power accelerators at Sandia. The software achieves flexibility by being entirely table driven. Before each accelerator shot the program processes input files and then sets up and checks out all programmable hardware. After the shot the program automatically reads each signal, calibrates it and stores it in a disc file. The software is currently running in 3 different facilities with up to 60 waveform recorder channels.

13041 **(UCID—19984) Pretreatment of Kapton-coated cable for epoxy adhesion.** Carley, J.F. (Lawrence Livermore National Lab., CA (USA)). 9 Jan 1984. Contract W-7405-ENG-48. 11p. NTIS, PC A02/MF A01. Order Number DE84006265.

Preliminary testing of a new system for protecting bonded strain gages that will be attached to the MFTF magnets indicated falling electrical resistance to ground, attributed to the infiltration of moisture. The most likely infiltration route seemed to be along the Kapton lead cable, which has an outer surface of FEP fluorocarbon resin. Samples of the cable were pretreated with a fluorocarbon etchant, Tetra-Etch, for periods of 10, 25, and 40 s at room temperature, followed by rinsing with demineralized water. The treated ends were embedded in the proposed epoxy sealant, Hysol EA 934, a compound containing 70 wt % of asbestos. The tensile-shear stresses required to pull the wires out of these embedments were measured. Results show that the three levels of treatment are equally effective in raising the bond strength from 377 psi for the untreated cable to about twice that, 763 psi. The 40-s exposure to Tetra-Etch appears to have penetrated the 0.5-mil fluorocarbon coating and attacked the Kapton film and the conductor coatings inside it.

13042 **(UCRL—15574) Neutral beam injector for 475 keV MARS sloshing ions.** Goebel, D.M.; Hamilton, G.W. (TRW, Inc., Redondo Beach, CA (USA); Lawrence Livermore National Lab., CA (USA)). 13 Dec 1983. Contract W-7405-ENG-48. 34p. NTIS, PC A03/MF A01. Order Number DE84004756.

A neutral beam injector system which produces 5 MW of 475 keV D^0 neutrals continuously on target has been designed. The beamline is intended to produce the sloshing ion distribution required in the end plug region of the conceptual MARS tandem mirror commercial reactor. The injector design utilizes the LBL self-extraction negative ion source and Transverse Field Focusing (TFF) accelerator to generate a long, ribbon ion beam. A laser photodetachment neutralizer strips over 90% of the negative ions. Magnetic and neutron shield designs are included to exclude the fringe fields of the end plug and provide low activation by the neutron flux from the target plasma. The use of a TFF accelerator and photodetachment neutralizer produces a total system electrical efficiency of about 63% for this design.

13043 **(UCRL—89192) Mechanical construction of the 22 Nova laser.** Hurley, C.A.; Frick, F.A.; Patton, H.G.; Bradley, G.; Martos, A. (Lawrence Livermore National Lab., CA (USA)). 22 Nov 1983. Contract W-7405-ENG-48. 29p. (CONF-831203—86). NTIS, PC A03/MF A01. Order Number DE84005432.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

The Nova laser system for Inertial Confinement Fusion studies at Lawrence Livermore National Laboratory is under construction and will be completed October 1984 with first operations scheduled for 1985. This system is the largest precision opto-mechanical engineering system ever built. Major engineering and subsystems are mechanical, optical, and electrical power. A series of system technologies include alignment, diagnostics, target, frequency conversion, and controls. This paper will only discuss the mechanical system.

13044 **(UCRL—89318) Magnetic shielding design analysis.** Kerns, J.A.; LaPaz, A.D.; Fabyan, J. (Lawrence Livermore National Lab., CA (USA)). 27 Dec 1983. Contract W-7405-ENG-48. 6p. (CONF-831203—78). NTIS, PC A02/MF A01. Order Number DE84005136.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

Two passive magnetic-shielding-design approaches for static external fields are reviewed. The first approach uses the shielding solutions for spheres and cylinders while the second approach requires solving Maxwell's equations. Experimental data taken at LLNL are compared with the results from these shieldings-design methods, and improvements are recommended for the second method. Design considerations are discussed here along with the importance of material gaps in the shield.

13045 **(UCRL—89371) Fusion power demonstration - a baseline for the mirror engineering test reactor.** Henning, C.D.; Logan, B.G.; Neef, W.S.; Dorn, D.; Clarkson, I.R.; Carpenter, T.; Gordon, J.D.; Campbell, R.B.; Hsu, P.; Nelson, D. (Lawrence Livermore National Lab., CA (USA); Grumman Aerospace Corp., Bethpage, NY (USA); TRW Energy Systems Group, Redondo Beach, CA (USA); Idaho National Engineering Lab., Idaho Falls (USA); Oak Ridge National Lab., TN (USA)). 2 Dec 1983. Contract W-7405-ENG-48. 9p. (CONF-831203—82). NTIS, PC A02/MF A01. Order Number DE84004806.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

Developing a definition of an engineering test reactor (ETR) is a current goal of the Office of Fusion Energy (OFE). As a baseline for the mirror ETR, the Fusion Power Demonstration (FPD) concept has been pursued at Lawrence Livermore National Laboratory (LLNL) in cooperation with Grumman Aerospace, TRW, and the Idaho National Engineering Laboratory. Envisioned as an intermediate step to fusion power applications, the FPD would achieve DT ignition in the central cell, after which blankets and power conversion would be added to produce net power. To achieve ignition, a minimum central cell length of 67.5 m is needed to supply the ion and alpha particles radial drift pumping losses in the transition region. The resulting fusion power is 360 MW. Low electron-cyclotron heating power of 12 MW, ion-cyclotron heating of 2.5 MW, and a sloshing ion beam power of 1.0 MW result in a net plasma Q of 22. A primary technological challenge is the 24-T, 45-cm bore choke coil, comprising a copper hybrid insert within a 15 to 18 T superconducting coil.

13046 **(UCRL—89438) Configuration and layout of the tandem mirror Fusion Power Demonstrator.** Clarkson, I.R.; Neef, W.S. (Grumman Aerospace Corp., Bethpage, NY (USA); Lawrence Livermore National Lab., CA (USA)). 30 Nov 1983. Contract W-7405-ENG-48. 10p. (CONF-831203—75). NTIS, PC A02/MF A01. Order Number DE84004804.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

Studies have been performed during the past year to determine the configuration of a tandem mirror Fusion Power Demonstrator (FPD) machine capable of producing 1750 MW of fusion power. The FPD is seen as the next logical step after the Mirror Fusion Test Facility-B (MFTF-B) toward operation of a power reactor. The design of the FPD machine allows a phased construction: Phase I, a hydrogen or deuterium checkout machine; Phase 2, a DT breakeven machine; Phase 3, development of the Phase 2 machine to provide net power and act as a reactor demonstrator. These phases are essential to the development of remote handling equipment and the design of components that will ultimately be remotely handled. Phasing also permits more modes funding early in the program with some costs committed only after reaching major milestones.

13047 **(UCRL—90036) Tandem mirror fusion research.** Baldwin, D.E. (Lawrence Livermore National Lab., CA (USA)). 2 Dec 1983. Contract W-7405-ENG-48. 19p. (CONF-831205—6). NTIS, PC A02/MF A01. Order Number DE84005133.

From 6. Miami international conference on alternative energy sources; Miami Beach, FL, USA (12 Dec 1983).

The tandem mirror program has evolved considerably in the last decade. Of significance is the viable reactor concept embodied in the MARS design. An aggressive experimental program, culminating in the operation of MFTF-B in late 1986, will provide a firm basis for refining the MARS design as necessary for constructing a reactor prototype in the 1990s.

13048 **(UCRL—90054) Novette facility: activation and preliminary experimental results.** Manes, K.R. (Lawrence Livermore National Lab., CA (USA)). 30 Nov 1983. Contract W-7405-ENG-48. 8p. (CONF-831203—96). NTIS, PC A02/MF A01. Order Number DE84005213.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

The construction and performance of the Novette Laser/Target interaction system are described.

13049 **The status of the federal magnetic fusion program, or fusion in transition: from science to technology.** Kane, J.S. (Department of Energy). *Energy Technology (Washington, D.C.);* **10**: 1202-1208(Jun 1983). (CONF-830213—).

From 10. energy technology conference; Washington, DC, USA (28 Feb 1983).

The current status of magnetic fusion is summarized. The science is in place; the application must be made. Government will have to underwrite the risk of the program, but the private sector must manage it. Government officials must be convinced fusion is in the interest of the taxpayer, private sector decision makers that it is commercial. Questions concerning reliability, availability, first cost, safety, environment, and sociology must be asked. Fusion energy is essentially inexhaustible, appears environmentally acceptable, and is one of a very short list of alternatives.

13050 **A simple computational form for Maxwellian reactivities.** Hively, L.M. (Oak Ridge National Laboratory, General Electric Company/Fusion Engineering Design Center, P.O. Box Y, Oak Ridge, Tennessee 37830). *Nuclear Technology;* **3**: No. 2, 199-201(Mar 1983).

A simple form is given for the evaluation of Maxwellian reactivities for the reactions $T(d,n)^4He$, $D(d,p)T$,$D(d,n)^3He$, and $^3He(d,p)^4He$, with applications to the analytical treatment of fusion reactor problems.

13051 **Producing thermochemical hydrogen with the tandem mirror reactor.** Werner, R.; Hickman, R.G. (Lawrence Livermore National Laboratory, Livermore, CA). *Proceedings, Intersociety Energy Conversion Engineering Conference;* **3**: 1345-1354(Aug 1982). (CONF-820814—). Contract W-7405-ENG-48.

From 17. Intersociety Energy Conversion Engineering conference; Los Angeles, CA, USA (8 Aug 1982).

Fusion power holds the promise to supply not only electricity but also fuels to meet the balance of our energy needs. A new integrated power and breeding blanket design is described for tandem mirror reactors. The blanket incorporates features that make it suitable for synthetic fuel production. In particular, it is matched to the thermal and electrical power requirements of the General Atomic watersplitting process for production of hydrogen. Some improvements to the high temperature chemical process steps are described. These improvements are expected to allow production of hydrogen at about $13/GJ wholesale, including financing costs, capital amortization, and profit.

13052 **Status of the fusion engineering device (FED) program.** Shannon, T. (Fusion Engineering Design Center, Oak Ridge National Laboratory). *Proceedings, Intersociety Energy Conversion Engineering Conference;* **3**: 1352-1356(Aug 1982). (CONF-820814—). Contract W-7405-ENG-26.

From 17. Intersociety Energy Conversion Engineering conference; Los Angeles, CA, USA (8 Aug 1982).

The USA Magnetic Fusion Energy Program has been examining options for the next major device since the mid-1970s. The Tokamak Fusion Test Reactor (TFTR) now under construction at the Princeton Plasma Physics Laboratory was established as a capital project in 1975. One year earlier, while the TFTR was still in the conceptual design phase, the Department of Energy began to plan for the next major device to follow. Now, almost eight years later, the TFTR construction is nearing completion, and the definition of the concept for the next major device is still the subject of intense study nationwide. This paper reviews the evolution of the next step program, now called the Fusion Engineering Device (FED), with primary focus on the key engineering problems and how they are being addressed.

13053 **MARS - the Mirror Advanced Reactor Study.** Gordon, J.D. (TRW, Redondo Beach, CA). *Proceedings, Intersociety Energy Conversion Engineering Conference;* **3**: 1363-1366(Aug 1982). (CONF-820814—).

From 17. Intersociety Energy Conversion Engineering conference; Los Angeles, CA, USA (8 Aug 1982).

The Mirror Advanced Reactor Study (MARS) is being performed by a team lead by Lawrence Livermore National Laboratory and includes TRW, The University of Wisconsin, General Dynamics Convair, Ebasco Services, Science Applications, the Energy Technology Engineering Center, and Grumman Aerospace. The roles of the team members are shown. The principal objectives of the MARS design are an economically and environmentally attractive tandem mirror reactor with efficient electricity production as the primary product. High temperature process heat for production of synthetic fuels is a secondary product. The reactor design emphasizes the many advantages of the tandem mirror for producing commercial power through fusion. Thus, MARS will serve as a strategic goal for the Mirror Fusion Program by establishing physics and technology requirements.

13054 **Engineering test facility vacuum pumping duct shield analysis.** Urban, W.T.; Dudziak, D.J.; Seed, T.J. (Los Alamos National Laboratory, University of California, Theoretical Division, Los Alamos, New Mexico). *Nuclear Technology/Fusion;* **2**: No. 2, 261-271(Apr 1982).

A nucleonic analysis of the Engineering Test Facility vacuum pumping (VP) duct shield has been performed using a coupled Monte Carlo/discrete ordinates method. This method used Monte Carlo to determine internal and external boundary surface sources for subsequent use in discrete ordinates calculations of the neutron and gamma-ray transport through the shield. Confidence in both the coupled method and the results obtained through its use was provided through comparisons with three-dimensional Monte Carlo results. Calculations in the toroidal plasma chamber and the neutral beam injector duct, which were required prior to the VP duct shield calculations, are also described.

13055 **Neutron and gamma-ray streaming calculations for the engineering test facility neutral beam injectors.** Lillie, R.A.; Alsmiller, R.G. Jr.; Santoro, R.T. (Oak Ridge National Laboratory, Oak Ridge, Tennessee). *Nuclear Technology/Fusion;* **2**: No. 2, 325-331(Apr 1982).

Two-dimensional radiation transport methods have been used to estimate the effects of neutron and gamma-ray streaming on the performance of the Engineering Test Facility neutral beam injectors. The calculations take into account the spatial, angular, and spectral distributions of the radiation entering the injector duct. The instantaneous nuclear heating rate averaged over the length of the cryopumping panel in the injector is 7.5×10^{-3} MW/m³, which implies a total heat load of 2.2×10^{-4} MW. The instantaneous dose rate to the ion gun insulators was estimated to be 3200 rad/s. The radial dependence of the instantaneous dose equivalent rate in the neutral beam injector duct shield was also calculated.

13056 **Mechanical engineering aspects of the TFTR.** Citrolo, J.C. (Plasma Physics Laboratory, Princeton University, Princeton, NJ). *American Society of Mechanical Engineers, [Paper]:* **82-WA/NE-5**: 6(1982). (CONF-821101—).

From ASME winter annual meeting (Engineering applications of laser velocimetry/published in ASME Jr. Fluid Engineering); Phoenix, AZ, USA (14 Nov 1982).

The Toroidal Fusion Test Reactor (TFTR) is a large experimental Fusion Reactor which is being built at the Plasma Physics Laboratory of Princeton University. The TFTR belongs to a class of experimental devices known as a TOKAMAK, and is intended to demonstrate thermonuclear breakeven where the power from the Deuterium-Tritium reaction is equal to the injected input power. This paper briefly presents the principals which characterize a TOKAMAK and discusses the mechanical aspects of the TFTR, particularly the Toroidal Field Coils and the vacuum chamber, in the context of being key components common to all TOKAMAKS. The mechanical loads on these items as well as other design requirements are considered and the solutions to these requirements as executed in the TFTR are presented. Current high priority engineering efforts are now addressing the design and development of the plasma limiter system and the vacuum vessel protective armor. High heat loads and eddy current forces are key considerations which are discussed in relation to the design of these components. Future technological developments, beyond the scope of TFTR, which are necessary to bring the TOKAMAK concept to a full fusion power system are also presented. Additional methods of plasma heating, current drive and first wall designs are examples of items in this category which are discussed.

13057 **Engineering challenges encountered in the design of the ELMO BUMPY TORUS proof-of-principle fusion device.** Dillow, C.F.; Imster, H.F. (McDonnell Douglas Astronautics Company, P.O. Box 516, St. Louis, MO). *American Society of Mechanical Engineers, [Paper]:* **82-WA/NE-6**: 8(1982). (CONF-821101—).

From ASME winter annual meeting (Engineering applications of laser velocimetry/published in ASME Jr. Fluid Engineering); Phoenix, AZ, USA (14 Nov 1982).

This paper first provides a summary of the history and current status of the Elmo Bumpy Torus (EBT) fusion concept. A brief description of the EBT-P is then provided in which the many unique features of this fusion device are highlighted. This description will provide the technical background for the following discussions of some of the more challenging mechanical engineering problems encountered to date in the evolution of the EBT-P design. The problems discussed are: optimization of the device primary structure design, optimization of the superconducting magnet x-ray shield design, design of the liquid helium supply and distribution system, and selection of high vacuum seals and pumps and their protection from the high power microwave environment. The common challenge in each of these design issues was to assure adequate performance at minimum cost.

13058 **Mechanical design aspects of laser driven fusion.** Miller, W.O.; Bohachevsky, I.O.; Zeigner, V.L. (Los Alamos National Laboratory, University of California, Los Alamos, New Mexico). *American Society of Mechanical Engineers, [Paper]:* **82-WA/NE-7**: 11(1982). (CONF-821101—).

From ASME winter annual meeting (Engineering applications of laser velocimetry/published in ASME Jr. Fluid Engineering); Phoenix, AZ, USA (14 Nov 1982).

The feasibility of using a Carbon Dioxide (CO_2) laser-driver to achieve the fusion reaction of a deuterium-tritium (D-T) gas mixture is being investigated at the Los Alamos National Laboratory. This program is a major element in the National Inertial Fusion Program sponsored by the Department of Energy in their quest to develop a virtually inexhaustible energy source. Impetus for harnessing the D-T fusion reaction in a commercially viable power generation scheme has grown steadily with depletion of our once abundant hydrocarbon resources. Attendant with this vast untapped energy source are the immense engineering difficulties which must be resolved before the goal is attained. This paper discusses current efforts at Los Alamos, factors to be considered in potential commercial power generation systems, and the likelihood of success.

99 GENERAL AND MISCELLANEOUS

9901 Management

13059 **(DOE/MA—0142) Department of Energy Annual Procurement and Federal Assistance Report, FY 1983.** (USDOE Assistant Secretary for Management and Administration, Washington, DC. Directorate of Procurement and Assistance Management). Jan 1984. 34p. NTIS, PC A03/MF A01. Order Number DE84006269.

The information given on procurement, small purchase, and federal assistance activity was extracted from the Procurement and Assistance Data System (PADS). Geographic distribution of FY 1983 obligations, the top 100 contractors by FY 1983 obligations, the top 100 small business contractors, and top 100 awardees are among the data included.

13060 **(DOE/MI/01000—T1) Assessment of subcontracting opportunities for minority owned small business in the Defense Program Division of the United States Department of Energy. Final report.** Garza, D.T. (InterAmerica Research Associates, Inc., Rosslyn, VA). 32 Mar 1981. Contract AC01-80MI01000. 56p. NTIS, PC A04/MF A01. Order Number DE84006142.

The subcontract market within the weapons manufacture and nuclear production facilities operated for Defense Programs (DP) by government owned, contractor operated (GOCO) concerns was analyzed. The objective of this study was to determine the nature and extent of subcontracting opportunities for minority business enterprises (MBEs), especially in high technology requirements. Giving impulse to the project was the need to understand how DP, in compliance with Public Law 95-507, could better attain its goals for minority business paticipation as well as to determine the existence and availability of minority firms which could be matched to high-tier subcontracting opportunities. Many actual and potential opportunities of a high technology or high skills requirement exist for which minority firms can be utilized. The matrix included in this study amply demonstrates the range of subcontracting activities within the various Operations Offices and GOCOs. A growing number of minority owned businesses exist with the capability of providing goods and services requiring advanced technology. The accompanying directory of select minority firms compiled and indexed to match these subcontracting opportunities illustrates this finding. For example, over one hundred fifteen minority firms provide engineering design services; eighty-seven provide various electrical and electronic state-of-the-art services, and sixty-five provide computer software.

13061 **(DOE/MI/01000—T2) Guide of minority owned firms in technical opportunity areas within the Defense Programs Division of the United States Department of Energy. Final report.** Garza, D.T. (InterAmerica Research Associates, Inc., Rosslyn, VA). 31 Mar 1981. Contract AC01-80MI01000. 129p. NTIS, PC A07/MF A01. Order Number DE84005730.

Numerous opportunities for new business for minority owned firms are present within the Defense Programs (DP) of the Department of Energy (DOE); and a relatively sizeable number of minority business enterprises (MBEs) are available as subcontractors for work utilizing advanced technology. Indexed according to subcontracting categories which are identified as opportunity areas, the Guide easily locates minority firms with corresponding capabilities and characteristics. Under each category in the Guide, individ-

ual firms are also alphabetically listed, with descriptions of their capabilities and a contact name. Capabilities of some firms are described in greater detail to indicate the full range of their services, as such information was available. In cases of multiple capabilities, firms are cross-referenced with other related categories.

13062 **(DOE/ZZ/00859—T1) Administrative and organizational development support services for energy technology. Final technical report, September 30, 1978-November 31, 1980.** Kendrick, J.E. (Kendrick and Co., Washington, DC (USA)). [nd]. Contract AC01-78ZZ00859. 12p. NTIS, PC A02/MF A01. Order Number DE84005359.

Kendrick and Company performed administrative and organizational development support services for the US Department of Energy between September 30, 1978 and November 30, 1980. During Fiscal Year 1979, the services were for Energy Technology's Office of Resource Management and Acquisition. When Energy Technology was abolished, the Kendrick and Company contract was transferred to Fossil Energy. It covered human resource management, a contract information system, presentation support services, editorial services, and quick response services.

13063 **(DP-MS—83-105) Use of microcomputers for inventory management with uncertain demand.** Meadows, B.F. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). 1984. Contract AC09-76SR00001. 16p. (CONF-840138—1). NTIS, PC A02/MF A01. Order Number DE84005179.

From American Production and Inventory Control Society specialty seminar; Palm Springs, CA, USA (30 Jan 1984).

This paper describes how a microcomputer is used for analysis of inventory trends to optimize inventory investment and customer service level in a distribution environment with uncertain demand, and to support an inventory subsystem resident on a main computer.

13064 **(LBL-PUB—3021-Rev.) Personnel action form instructions. Revision.** (Lawrence Berkeley Lab., CA (USA)). Dec 1983. Contract AC03-76SF00098. 49p. NTIS, PC A03/MF A01. Order Number DE84005545.

13065 **(NUREG—0325-Rev.6) US Nuclear Regulatory Commission functional organization charts. Revision 6.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Resource Management). 1 Jan 1984. 57p. NTIS, PC A04/MF A01 - GPO $4.25. Order Number DE84900652.

The report consists entirely of organizational charts of the US NRC, with functional notes for each office. (GHT)

13066 **(PNL—4939) R & D intensities in US industries.** Fang, J.M.; Skumatz, L.A. (Pacific Northwest Lab., Richland, WA (USA)). Jan 1984. Contract AC06-76RL01830. 61p. NTIS, PC A04/MF A01. Order Number DE84005329.

Data are presented on the R & D intensities in US industries, defined to represent R & D expenditures as percentages of sales. Both company-funded and total (including federal funding) intensities are examined. The variations of the R & D intensities among industries and over time are also described. Qualitative discussions are provided on some probable causes underlying the inter-industry and temporal variations of the intensities. At the industry level, the intensity information was used to categorize the individual industries into five groups: high, above-average, average, below-average, and low intensity. Data on individual firms were also examined for the aerospace, automotive, chemical, computer and office equipment, and electronics and semiconductor industries. Although other data sources were also consulted, the study relies primarily upon two published data sources: National Science Foundation's Research and Development in Industry series and Business Week's R & D Scoreboard.

13067 **(SAND—83-1951C) Project planning in a friendly environment.** Becktell, M.J. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 13p. (CONF-830245—1-Draft). NTIS, PC A02/MF A01. Order Number DE84001778.

From Energy sources technology conference; New Orleans, LA, USA (13 Feb 1983).

There is a planning technique which can be used to involve project participants in a team planning process. They develop the project plan with their colleagues and managers. The engineers and researchers are then the planners of their own project, and as such, have a direct influence on the credibility and reality of the plan. This technique is used for the planning and tracking of high technology, high risk Energy R and D projects at Sandia National Laboratories. The planning of R and D projects can be developed in a Friendly Environment and the rewards are seen in a new kind of project control which is shared by the managers, the principal investigators, engineers, and other participants. This paper describes how you can institute a Friendly Environment for the planning of your projects.

9902 Mathematics And Computers

REFER ALSO TO CITATION(S) 12507, 12516, 12517, 13063, 13083

13068 **(ANL/MCS-TM—12) EISPACK: a package for solving matrix eigenvalue problems.** Dongarra, J.J.; Moler, C.B. (Argonne National Lab., IL (USA)). Aug 1983. Contract W-31-109-ENG-38. 27p. NTIS, PC A03/MF A01. Order Number DE84005408.

This is a two part paper on the software package EISPACK. The first part describes the development and usage of the EISPACK and is intended as an introduction to the package. The second part describes changes made to the package for the current release and how to install the package. EISPACK is a systemized collection of subroutines that compute the eigenvalues and eigenvectors of different classes of matrices.

13069 **(CEA-CONF—6815) ARIANE: a system to facilitate scientific programming.** Kavenoky, A.; Robeau, M.F. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). May 1983. 13p. (In French). (CONF-830531—4). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750441.

From International conference on tools, methods, and languages for scientific and engineering computation; Paris, France (17 May 1983).

FORTRAN - IBM - Cray 1.

A very great development, maintenance and exploitation facility of the scientific programmes is enabled at the present time by ARIANE system. Principal computing problems against which uses and big codes designers are coming up can be resolved with it. The different functions of ARIANE system are presented; some performances are quoted. ARIANE on IBM computer working under OS/VS1 or VS2 system and on Cray-1 computer.

13070 **(CONF-831239—5) SALTD dynamic systems code.** Berry, G.; Geyer, H. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 6p. NTIS, PC A02/MF A01. Order Number DE84005415.

From Systems simulation symposium of fossil fuel conversion processes; Morgantown, WV, USA (6 Dec 1983).

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A dynamic systems code has been developed for the dynamic analysis of power plants. The code has been used to analyze power plant transients and determine control system design specifications. The SALTD code is an enhancement to the SALT systems code, which was also developed at ANL. The code has numerous features that make it more usable than similar dynamics systems codes based on the CSMP concept. The SALTD code contains two distinct steady state finder methods. The code can either solve the dynamic equations (with derivatives set to zero), using a sophisticated nonlinear N-dimensional equation solver, or it can use a fast integration scheme to determine the steady-state solution. The code also uses precompiled models, which allows the system to be set up much more easily and does not waste valuable computer time to sort and recompile every single model (as is customary in many dynamic systems codes). This feature is very helpful in a design situation or an R and D environment, where the system configuration and design parameters are subject to change. Finally, the integra-

tion algorithm is an enhancement to the GEAR package, which also solves nonlinear algebraic equations and takes into account the sparsity in the Jacobian (this leads to a quicker redetermination of the Jacobian and its inverse).

13071 **(DOE/ER/10473—T2) Data flow computer architecture.** Dennis, J.B. (Massachusetts Inst. of Tech., Cambridge (USA). Lab. for Computer Science). 1 Dec 1983. Contract AC02-79ER10473. 11p. NTIS, PC A02/MF A01. Order Number DE84004198.

In the fifteen months from September 1, 1982 through November 30, 1983, the Computation Structures Group has continued its work toward the construction of practical data flow computers and toward their application to important practical problems. Areas in which substantial progress has been made with DOE support include the mapping of high-level programs into efficient data flow machine programs for the static data flow architecture, and the development of trial designs for some of the custom circuits needed to construct high-performance data flow computers. Our studies of benchmark computational problems obtained from sponsors have been augmented through study of a plasma simulation problem from the Los Alamos Laboratory and an image processing problem from the MIT Lincoln Laboratory. In addition we are exploring the design of program testing and debugging support software for use with functional programming languages and data flow architectures, and our preliminary work on the design of LSI parts has been accompanied by an evolution of ideas concerning hardware design methodology. Two journal articles have been prepared to report our work on applying data flow ideas to the design of computer system. The first presents our proposed architecture for a high-performance data flow supercomputer, and includes an analysis of one benchmark problem, the weather model. The second article reports the principles underlying the use of dynamic data flow instruction execution to support a general purpose programming environment for a community of users.

13072 **(EGG-IS—6511) Emacs primer.** Anderson, B.H. (EG and G Idaho, Inc., Idaho Falls (USA)). Jan 1984. Contract AC07-76ID01570. 69p. NTIS, PC A04/MF A01. Order Number DE84005482.

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Unix Emacs is an editor in that it is primarily used for typing in and modifying documents, programs, or anything else that is represented as text. It uses a display to interact with the user, always keeping an accurate representation of what is happening visible on the screen that changes in step with the changes made to the document. The feature that distinguishes Emacs from most other editors is its extensibility. That is, a user of Emacs can dynamically change Emacs to suit their own needs.

13073 **(LA-UR—83-2940) Los Alamos Science, Fall 1983 No. 9.** Cooper, N.G. (ed.). (Los Alamos National Lab., NM (USA)). Fal 1983. Contract W-7405-ENG-36. 78p. NTIS, PC A02/MF A01. Order Number DE84004048.

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Topics covered in this issue include: cellular automata, gene expression, gen-bank and its promise for molecular genetics, and frontiers of supercomputing. Abstracts have been prepared for the individual items. (GHT)

13074 (LA-UR—83-2940, pp 2-21) **Cellular automata.** Wolfram, S. Fal 1983. NTIS, PC A02/MF A01.

In Los Alamos Science, Fall 1983 No. 9.

To discover and analyze the mathematical basis for the generation of complexity, one must identify simple mathematical systems that capture the essence of the process. Cellular automata are a candidate class of such systems. This article surveys their nature and properties, concentrating on fundamental mathematical features. Cellular automata promise to provide mathematical models for a wide variety of complex phenomema, from turbulence in fluids to patterns in biological growth. The general features of their behavior discussed here should form a basis for future detailed studies of such specific systems.

13075 (LA-UR—83-2940, pp 22-27) **From Turing and von Neumann to the present.** Cooper, N.G. Fal 1983. NTIS, PC A02/MF A01.

In Los Alamos Science, Fall 1983 No. 9.

A brief history is given of the development of digital computers and artificial intelligence. (GHT)

13076 (LA-UR—83-2940, pp 64-70) **Frontiers of supercomputing.** Buzbee, B.L.; Metropolis, N.; Sharp, D.H. Fal 1983. NTIS, PC A02/MF A01.

In Los Alamos Science, Fall 1983 No. 9.

How can the United States maintain its worldwide supremacy in supercomputing. What policies and strategies are needed to make the revolutionary step to massively parallel supercomputers. How can individual efforts in computer architecture, software, and languages be best coordinated for this purpose. To discuss these questions, the Laboratory and the National Security Agency sponsored a conference in Los Alamos on August 15-19, 1983. Entitled Frontiers of Supercomputing, the conference brought together leading representatives from industry, government, and universities who shared the most recent technical developments as well as their individual perspectives on the tactics needed for rapid progress. Before presenting highlights of the conference we review in more depth the importance of supercomputing and the trends in computer performance that form the background for the conference discussions.

13077 **(LBL—15525) Automatic, self-nulling, spectral scanning ellipsometer: software for the LSI-11 data acquisition system.** Muller, R.H.; Farmer, J.C. (Lawrence Berkeley Lab., CA (USA)). Mar 1983. Contract AC03-76SF00098. 338p. NTIS, PC A15/MF A01. Order Number DE83015007.

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The automatic, magneto-optic ellipsometer reported previously (1) has been given spectral scanning capabilities in the visible-uv, and has been interfaced to an LSI-11/2 for data acquisition. FORTRAN software is documented for the acquisition of both fixed-wavelength and spectroscopic data from an automatic, self-nulling ellipsometer by an LSI-11 microcomputer. This ellipsometer has resulted from the addition of spectral scanning capabilities over the visible-uv to a previously reported (1) automatic, magneto-optic instrument. Additional programs are presented to aid in the interpretation of the acquired ellipsometry data. Software is categorized as being for either (a) fixed-wavelength data collection; (b) spectroscopic data collection, reduction, and simulation; (c) graphics; or (d) modeling and optimization. The most basic ellipsometry equations have also been programmed for a Texas Instruments 59 calculator, and are presented because of their proven usefulness, convenience, and popularity.

13078 **(SOL—83-20) MINOS 5.0 user's guide.** Murtagh, B.A.; Saunders, M.A. (Stanford Univ., CA (USA). Systems Optimization Lab.). Dec 1983. Contract AT03-76ER72018. 126p. NTIS, PC A07/MF A01. Order Number DE84005640.

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MINOS is a large-scale optimization system, for the solution of sparse linear and nonlinear programs. The objective function and constraints may be linear or nonlinear, or a mixture of both. The nonlinear functions must be smooth. Stable numerical methods are employed throughout. Features include a new basis package (for maintaining sparse LU factors of the basis matrix), automatic scaling of linear contraints, and automatic estimation of some or all gradients. Upper and lower bounds on the variables are handled efficiently. File formats for constraint and basis data are compatible with the industry MPS format. The source code is suitable for machines with a Fortran 66 or 77 compiler and at least 500K bytes of storage.

13079 **(UCID—19912) User's manual SIG: a general-purpose signal processing program.** Lager, D.; Azevedo, S. (Lawrence Livermore National Lab., CA (USA)). 25 Oct 1983. Contract W-7405-ENG-48. 74p. NTIS, PC A04/MF A01. Order Number DE84002678.

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SIG is a general-purpose signal processing, analysis, and display program. Its main purpose is to perform manipulations on time- and frequency-domain signals. However, it has been designed to ultimately accommodate other representations for data such as multiplexed signals and complex matrices. Many of the basic operations one would perform on digitized data are contained in the core SIG package. Out of these core commands, more powerful signal processing algorithms may be built. Many different operations on time- and frequency-domain signals can be performed by SIG. They include operations on the samples of a signal, such as adding a scalar to each sample, operations on the entire signal such as digital filtering, and operations on two or more signals such as adding two signals. Signals may be simulated, such as a pulse train or a random waveform. Graphics operations display signals and spectra.

13080 **A canonical integration technique.** Ruth, R.D. (Lawrence Berkeley Lab., Berkeley, CA 94720). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-30: No. 4, 2669-2671(Aug 1983). (CONF-830311—).

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The class of differential equations of interest to this paper is that in which the equations are derivable from a Hamiltonian by the use of Hamilton's equations. The exact solution of such a system of differential equations leads to a symplectic map from the initial conditions to the present state of the system. A characteristic feature of all explicit higher order integration methods, however, is that they are not exactly symplectic. In many applications the salient features appear only after a long time or after numerous iterations; in these applications spurious damping or excitation may lead to misleading results. The purpose of this paper is to develop an explicit third order symplectic map (i.e. a third order integration step which preserves exactly the canonical character of the equations of motion) and to indicate the method for higher order maps. For a typical numerical integration, this method can be used to eliminate the noncanonical effects while providing the accuracy corresponding to a third order integration step.

13081 **Scientific calculating peripheral.** Ethridge, C.D.; Nickell, J.D. Jr.; Hanna, W.H. (Los Alamos Scientific Lab., NM). *Compcon Fall;* 467-471(Sep 1979).

A scientific calculating peripheral for small intelligent data acquisition and instrumentation systems and for distributed-task processing systems is established with a number-oriented microprocessor controlled by a single component universal peripheral interface microcontroller. A MOS/LSI number-oriented microprocessor provides the scientific calculating capability with Reverse Polish Notation data format. Master processor task definition storage, input data sequencing, computation processing, result reporting, and interface protocol is managed by a single component universal peripheral interface microcontroller.

9903 Information Handling

REFER ALSO TO CITATION(S) 12147, 12759, 12760

13082 **(DOE/TIC/EGC—83/4) Energygrams: brief descriptions of energy technology.** Simpson, W.F. Jr. (ed.). (USDOE Technical Information Center, Oak Ridge, TN). 1983. 65p. (PB—83-903604). NTIS $8.00 single copy (subscription item).

Energygrams published by the Technical Information Center. The Center routinely screens all DOE R and D reports to identify appropriate information. It also coordinates with DOE and DOE Laboratory and Contractor program managers in identifying research and development projects for the transfer program and in reviewing the technical content of Energygrams before publication. Energygrams are usually one-page illustrated bulletins describing DOE technology or data and telling how to obtain the technical reports, patent documents, software or other material on which they are based. The compilation is organized by subject categories, and, within each category, Energygrams are presented alphabetically by Energygram title. The subject index is cumulated with each issue by calender year.

13083 **(LBL—16330) Graphic design for computer-based information management: a case study of Seedis.** Marcus, A. (Lawrence Berkeley Lab., CA (USA)). Sep 1983. Contract AC03-76SF00098. 18p. NTIS, PC A02/MF A01. Order Number DE84005873.

Portions are illegible in microfiche products. Original copy available until stock is exhausted.

This report summarizes the graphic design research, development, and implementation that the author has conducted over the last four years for a large geographic information management system called Seedis. Portions of this report have been assembled from diverse technical papers cited in the references and have been re-edited for presentation to both the computer graphics and the graphic design communities. This report describes Seedis and three different areas in which graphic design principles have been applied.

13084 **(UCID—19956) Wang OIS glossary package for reformatting documents telecommunicated to the OIS system.** Markow, S.R. (Lawrence Livermore National Lab., CA (USA)). 9 Dec 1983. Contract W-7405-ENG-48. 27p. NTIS, PC A03/MF A01. Order Number DE84005113.

Documents that are composed on a computer and then transmitted by telecommunications into a Wang Office Information System (OIS) word processing system need to be reformatted and cleaned up before they can be used properly as word processing documents suitable for further revisions or additions. This report describes a group of glossary entries created for the Wang OIS which simplifies the job of cleaning up telecommunicated documents. This glossary is a semi-automated process designed to eliminate most of the tedious work needed to be performed in removing extra spaces and returns, adjusting formats, moving material, repagination, using tabs or indents, and similar problems. The report briefly discusses the problems, describes the glossary approach to solving them, and gives instructions for actually using the glossary entries.

CORPORATE AUTHOR INDEX

In the Corporate Index, report literature is indexed using the name of the organization or institution responsible for issuing the report. Headings are provided for all report literature and for published literature for which a corporate approach is especially desirable, e.g., symposium and conference proceedings.

Each entry under a corporate heading gives the document title and the volume and abstract numbers. The document type, e.g., R for Report; country of publication, e.g., US; and language of the document, e.g., In German; are given in parentheses at the end of the entry. If no language statement appears, the language is English. Tables of document types and country of publication codes appear after the indexes.

DOE Energy Information Data Base: Corporate Author Entries (DOE/TIC-4585) is used in the standardization of corporate entries. DOE/TIC-4585 is available for purchase from the National Technical Information Service (NTIS), U. S. Department of Commerce, Springfield, Virginia 22161.

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The notations in the final parentheses indicate the type of document, e.g., R for Report; the country of publication, e.g., US; and the language if other than English, e.g., In German. Tables of document types and country of publication codes appear after the indexes.

The title may be supplemented with additional words, or a phrase, if it appears additional information would be helpful. In cases for which the title contains little or no information related to the subject entry, it may be replaced entirely by the supplementary information. A qualifier is not always required, and in such cases the title will follow the unqualified subject descriptor.

The descriptors selected for use as subject terms are generally the names of specific materials, things, or processes. To the extent possible, a qualifier is selected to describe the properties of, or processses applied to, the subject term.

Index entries are selected to indicate the important ideas and concepts presented in a document, rather than words that may appear in the text. Within the available thesaurus terms, the most probable or logical place to look for typical information is selected. "See references" are included to guide users from synonymous terms or phrases to the descriptor selected as a subject heading for the concept. (e.g. Pipeline Quality Gas see HIGH BTU GAS). "See also references" are used to indicate where to find references to subject concepts that are narrower, broader, or related to a particular subject heading. To complete an exhaustive search of a given subject, all such headings should be reviewed. Copies of DOE/TIC-7000, the Subject Thesaurus, are available from the National Technical Information Service (NTIS), U. S. Department of Commerce, Springfield, VA 22161.

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	9:12208	DOE/ET/15366—T3
AC01-78ET21055	**General Electric Co., Schenectady, NY (USA)**	
	9:11779	DOE/ET/21055—T3
AC01-78ET29636	**Dept. of Systems, Science and Math, Washington Univ., St. Louis, MO**	
	9:11862	IEEE (Institute of Electrical and Electronics Engineers) Transactions on Power Apparatus a
AC01-78ZZ00859	**Kendrick and Co., Washington, DC (USA)**	
	9:13062	DOE/ZZ/00859—T1
AC01-79CS20335	**Policy Planning and Evaluation, Inc., McLean, VA (USA)**	
	9:12222	DOE/CS/20335—T1
	9:12223	DOE/CS/20335—T2
	9:12224	DOE/CS/20335—T3
	9:12225	DOE/CS/20335—T5
	9:12226	DOE/CS/20335—T6
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AC01-79ET29361	**Scientific Systems, Inc., Cambridge, MA (USA)**	
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AC01-79ET29364	**Marco Corp., Fort Washington, PA**	
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AC01-80ER52069	**Intermagnetics General Corp., Guilderland, NY (USA)**	
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AC01-80ET13800	**Mitre Corp., McLean, VA (USA). METREK Div.**	
	9:11406	DOE/ET/13800—4
AC01-80MI01000	**InterAmerica Research Associates, Inc., Rosslyn, VA**	
	9:13060	DOE/MI/01000—T1
	9:13061	DOE/MI/01000—T2
AC02-76CH00016	**Brookhaven National Lab., Upton, NY (USA)**	
	9:11606	NUREG/CR—3018
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	9:12590	FERMILAB/TM—1229
AC02-76CH03073	**Princeton Univ., NJ (USA). Plasma Physics Lab.**	
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AC02-76CS40028	**Little (Arthur D.), Inc., Cambridge, MA (USA)**	
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AC02-76ER01195	**Illinois Univ., Urbana (USA). Dept. of Physics**	
	9:12896	DOE/ER/01195—489
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AC02-76ER01545	**Ohio State Univ., Columbus (USA). Dept. of Physics**	
	9:12910	DOE/ER/01545—342
AC02-76ER02718	**Missouri Univ., St. Louis (USA)**	
	9:12887	DOE/ER/02718—11
AC02-76ER02960	**Connecticut Univ., Storrs (USA). Dept. of Metallurgy**	
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AC02-76ER02978	**Cincinnati Univ., OH (USA)**	
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AC02-76ET20232	9:11837	
AC02-76ET37240	**Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Nuclear Engineering**	
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AC02-76ET53052	**Smithsonian Institution, Cambridge, MA (USA). Smithsonian Astrophysical Observatory**	
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AC02-77CH00178	**Solar Energy Research Inst., Golden, CO (USA)**	
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AC02-78ER04967	**State Univ. of New York, Binghamton (USA). Research Foundation**	
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AC02-78ER05002	**Massachusetts Inst. of Tech., Cambridge (USA)**	
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AC02-78ER14953	**Illinois Inst. of Tech., Chicago (USA). Dept. of Chemistry**	
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AC02-78ET51013	**Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center**	
	9:12985	DOE/ET/51013—93
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	9:12986	DOE/ET/51013—T2
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	9:13031	DOE/ET/51013—107
AC02-79CS50025	**Department of Mechanical Engineering, University of Wisconsin-Madison, Madison, WI 53706**	
	9:12322	American Society of Mechanical Engineers, [Paper] 83-DGP-1 9 (1983).
AC02-79ER10044	**Purdue Univ., Lafayette, IN (USA). Inst. for Interdisciplinary Engineering Studies**	
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AC02-79ER10386	**Syracuse Univ., NY (USA). Dept. of Chemical Engineering and Materials Science**	
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AC02-79ER10473	**Massachusetts Inst. of Tech., Cambridge (USA). Lab. for Computer Science**	
	9:13071	DOE/ER/10473—T2
AC02-79ET34006	**Consumers Power Co., Jackson, MI (USA)**	
	9:11871	DOE/ET/34006—10
AC02-79ET34014	**Westinghouse Electric Corp., Pittsburgh, PA (USA). Nuclear Energy Systems Div.**	
	9:11894	DOE/ET/34014—12
AC02-80ER10693	**SKF Industries, Inc., King of Prussia, PA (USA)**	
	9:12440	DOE/ER/10693—T1
AC02-80ET29310	**Corp. Research and Devel. Dept., General Electric Co., P.O. Box 43, Schenectady, NY 12301**	
	9:11758	IEEE (Institue of Electrical and Electronics Engineers) Transactions on Industry Applicati
AC02-80ET34031	**General Electric Co., San Jose, CA (USA)**	
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AC02-80EV10327	**Beth Israel Hospital, Boston, MA (USA). Div. of Nuclear Medicine**	
	9:12757	DOE/EV/10327—2
AC02-81CS90215	**Thermo Electron Engineering Corp., Waltham, MA (USA)**	
	9:12263	DOE/CS/90215—T1
AC02-81ER10866	**Northeastern Univ., Boston, MA (USA). Dept. of Physics**	
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AC02-81ER10942	**Michigan State Univ., East Lansing (USA). Dept. of Metallurgy, Mechanics and Material Science**	
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AC02-81EV10610	**New York Univ., NY (USA). Dept. of Applied Science**	
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AC02-81EV10694	**Woods Hole Oceanographic Institution, MA (USA)**	
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AC02-82CH10124	**Montana Energy Research and Development Inst., Butte (USA). Applied Technology Labs.**	
	9:12207	DOE/CH/10124—T2
AC02-82ER12039	**Charles F. Kettering Research Lab., Yellow Springs, OH (USA)**	
	9:12424	DOE/ER/12039—1
AC02-82ER53140	**Grumman Aerospace Corp., Princeton, NJ (USA)**	
	9:12983	DOE/ER/53140—12
AC02-82NE37254	**Wisconsin Univ., Madison (USA). Dept. of Nuclear Engineering**	
	9:12021	DOE/NE/37254—2
AC02-83CH10093	**Solar Energy Research Inst., Golden, CO (USA)**	
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	Grumman Aerospace Corp., Bethpage, NY (USA)	
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AC02-83CH10140	**Battelle Columbus Labs., OH (USA)**	
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AC03-76CS32391	**Louisiana State Univ., Baton Rouge (USA)**	
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AC03-76SF00098	**Univ. of California**	
	9:11498	Society of Petroleum Engineers of A.I.M.E. (American Institute of Mining, Metallurgical an

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AC03-76SF00515	**Stanford Linear Accelerator Center, CA (USA)**	
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AC03-76SF01011	**Agbabian Associates, El Segundo, CA (USA)**	
	9:11919	DOE/SF/01011—T25-Vol.1
	9:11920	DOE/SF/01011—T25-Vol.2
	9:11921	DOE/SF/01011—T25-Vol.4
AC03-78ER02029	**Rockwell International Corp., Thousand Oaks, CA (USA). Science Center**	
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AC03-78ET13333	**Combustion Teledyne CAE, Toledo, OH**	
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AC03-80CS24321	**Combustion Power Co., Inc., Menlo Park, CA (USA)**	
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AC03-81SF11573	**Science Applications, Inc., McLean, VA (USA). Energy Systems Group**	
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AC03-83SF11700	**Barber-Nichols Engineering Co., Arvada, CO (USA)**	
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AC04-76DP00613	**Bendix Corp., Kansas City, MO (USA)**	
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AC04-76DP00789	**Sandia National Labs., Albuquerque, NM (USA)**	
	9:11494	SAND—83-1755C
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	Sandia National Labs., Albuquerque, NM (USA)	
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AC04-76DP03533	**Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant**	
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AC04-79ET15303	**Ford Motor Co., Dearborn, MI (USA)**	
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AC05-76ER04014	**Florida Univ., Gainesville (USA). Dept. of Nuclear Engineering Sciences**	
	9:11981	DOE/ER/04014—13
AC05-76ET10143	**Ashland Synthetic Fuels, Inc., KY (USA)**	
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AC05-76OR00001		
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AC05-79CS56051	**Mueller Associates, Inc., Baltimore, MD (USA)**	
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	Hanford Engineering Development Lab., Richland, WA (USA)	
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	9:11574	HEDL-TME—83-32
	9:11603	HEDL-TC—2353-2
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AC06-76RL01830	**Pacific Northwest Lab., Richland, WA**	
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	Pacific Northwest Lab., Richland, WA (USA)	
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	Woodward-Clyde Consultants, San Francisco, CA (USA)	
	9:11586	BMI/ONWI—226
	Pacific Northwest Lab., Richland, WA (USA)	
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	Jet Propulsion Lab., Pasadena, CA (USA)	
	9:12265	JPL-PUB—83-74
	Auburn Univ., AL (USA)	
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	Pacific Northwest Lab., Richland, WA (USA)	
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	Pacific Northwest Lab., Richland, WA (USA)	
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AC06-77RL01030	**Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations**	
	9:11614	RHO-BW-SA—327P
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AC06-81ER10918	**Mathematical Sciences Northwest Inc.**	
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AC07-76ID01570	**EG and G Idaho, Inc., Idaho Falls (USA)**	
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	Idaho National Engineering Lab., Idaho Falls (USA)	
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	Pacific Northwest Lab., Richland, WA (USA)	
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AC07-78CS40191	**National Food Processors Association, Berkeley, CA (USA)**	
	9:12262	DOE/CS/40191—T2
AC07-79ID01675	**Exxon Nuclear Idaho Co., Inc., Idaho Falls (USA)**	
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AC07-82ID12239	**General Electric Co., Philadelphia, PA (USA). Advanced Energy Programs Dept.**	
	9:12264	DOE/ID/12239—T1
AC08-79ET27255	**Terra Tex**	
	9:11493	Society of Petroleum Engineers of A.I.M.E. (American Institute of Mining, Metallurgical an
AC09-76SR00001	**Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.**	
	9:11600	DPST—83-638
	9:11601	DPST—83-765
	9:11602	DPST—83-939
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	9:11987	DOE/SR/00001—T16

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	9:11991	DOE/SR/00001—T20
	9:11992	DOE/SR/00001—T21
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	9:12022	DPST—69-566
	9:12352	DP-MS—83-21
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	9:12730	DPST—83-307
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AC09-83SR11036	**Allied-General Nuclear Services, Barnwell, SC (USA)**	
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	9:11599	DOE/SR/11036—T17
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AC11-76PN00292	**Duquesne Light Co., Shippingport, PA (USA)**	
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AC13-76GJ01664	**Bendix Field Engineering Corp., Grand Junction, CO (USA). Grand Junction Operations**	
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AC21-80ET14928	**General Electric Co., Schenectady, NY (USA). Corporate Research and Development Center**	
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AC22-80PC30013	**Pennsylvania State Univ., University Park (USA). Coal Research Section**	
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AC22-83PC60047	**Cities Service Research and Development Co., Tulsa, OK (USA). Cities Service Technology Center**	
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AC22-83PC62999	**Cincinnati Univ., OH (USA). Kettering Lab.**	
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AC44-80R420006	**Gebhard (Thomas G.), Austin, TX (USA)**	
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AI01-77CS51040	**General Motors Corp., Indianapolis, IN (USA). Allison Gas Turbine Operations**	
	9:12320	DOE/NASA/0168—6
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AI01-81CS66001	**Jet Propulsion Lab., Pasadena, CA (USA)**	
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AS04-77CS33977	**New Mexico Univ., Albuquerque (USA). Dept. of Physics and Astronomy**	
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AS05-78ER06036	**Texas A and M Univ., College Station (USA). Cyclotron Inst.**	
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AS05-79ER10399	**Texas Univ., Austin (USA)**	
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AS05-82ER12094	**Rutgers—the State Univ., New Brunswick, NJ (USA). Dept. of Ceramics**	
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AS09-83ER13077	**Georgia Univ., Athens (USA). Research Foundation**	
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AT03-76SF70060	**GA Technologies, Inc., San Diego, CA (USA)**	
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613-3024	NTIS, PC A04/MF A01	DE84005876	MN -13	9:12648
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37	*See* CEA-CONF-6737	DE84750427	MN -34C	9:12946
38	*See* CEA-CONF-6735	DE84750428	MN -80	9:11916
CONF-820980-	(European Committee of future accelerators - the challenge of ultra-high energies conference, Oxford, UK, 27-30 Sep 1982)			
9	NTIS, PC A02/MF A01	DE84005496	MN -21	9:12980
CONF-8209134-	(IAEA interregional training course on waste management in nuclear facilities, Karlsruhe, F.R. Germany, 6 Sep-1 Oct 1982)			
32	*See* INIS-mf-8205	DE83704227	MN -41	9:11604

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1	*See* INIS-mf-8208	DE83704243	MN -2	9:11866
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CONF-830311-	(Particle accelerator conference, Santa Fe, NM, USA, 21-23 Mar 1983)			
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6	*See* CEA-CONF-6764	DE84750425	MN -34D	9:12918
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1	*See* CEA-CONF-6829	DE84750432	MN -80	9:11917
CONF-830423-	(5. symposium on safeguards and nuclear material management, Versailles, France, 19-21 Apr 1983)			
16	CEN Saclay, Service de Documentation, 91191 - Gif-sur-Yvette Cedex (France)			9:11662
CONF-830455-	(Yamada conference on muon spin rotation and associated problems, Shimoda, Japan, 18-27 Apr 1983)			
11	*See* LBL-16889	DE84005196	MN -34D	9:12905
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1	*See* CEA-CONF-6653	DE83704344	MN -80	9:11968
2	*See* CEA-CONF-6654	DE83704345	MN -80	9:12377
3	*See* CEA-CONF-6656	DE83704346	MN -80	9:11969
4	*See* CEA-CONF-6658	DE83704347	MN -80	9:11970
CONF-8304145-	(1. international congress on energy and agriculture, Milano, Italy, 27-29 Apr 1983)			
1	*See* ENEA-RT/FARE-SIN-83-2	DE84900246	MN -61a	9:11682
CONF-830508-	(163. Electrochemical Society meeting, San Francisco, CA, USA, 8-13 May 1983)			
28	*See* LBL-17014	DE84005535	MN -25	9:12359
CONF-830531-	(International conference on tools, methods, and languages for scientific and engineering computation, Paris, France, 17-19 May 1983)			
4	*See* CEA-CONF-6815	DE84750441	MN -32	9:13069
CONF-830538-	(6. international conference on radiation shielding, Tokyo, Japan, 16-20 May 1983)			
20	*See* CEA-CONF-6812	DE84750435	MN -20e	9:13013
21	*See* CEA-CONF-6809	DE84750437	MN -34C	9:12956
22	*See* CEA-CONF-6808	DE84750442	MN -20e	9:12955
23	*See* CEA-CONF-6807	DE84750443	MN -46	9:12954
24	*See* CEA-CONF-6810	DE84750444	MN -46	9:12957
25	*See* CEA-CONF-6813	DE84750445	MN -78	9:12010
26	*See* CEA-CONF-6811	DE84750446	MN -78	9:12958
CONF-830539-	(International meeting for radionuclide metrology - alpha particle spectrometry and low level measurement, Harwell, UK, 10-13 May 1983)			
5	*See* CEA-CONF-6775	DE84750430	MN -37	9:12398
CONF-830567-	(5. symposium on biotechnology for fuels and chemicals, Gatlinburg, TN, USA, 10-13 May 1983)			
6	NTIS, PC A03/MF A01	DE84006052	MN -61a	9:11677
CONF-830589-	(10. National Organization for the Professional Advancement of Black Chemists and Chemical Engineers (NOBCCHE) annual meeting, Knoxville, TN, USA, 25-28 May 1983)			
3	*See* LBL-16753	DE84005171	MN -4	9:12889
CONF-8305127-	(Spring college on radiation in plasmas, Trieste, Italy, 24 May-17 Jun 1983)			
3	*See* EUR-CEA-FC-1186	DE84750411	MN -20a	9:12995
4	NTIS, PC A02/MF A01; 1	DE84005497	MN -21	9:12562
CONF-8305134-	(4. European conference on CVD, Eindhoven, Netherlands, 31 May-2 Jun 1983)			
1	*See* AERE-R-10849	DE83704349	MN -77	9:11910
CONF-8305157-	(16. colloquium of numerical analysis, Guidel, France, 24-27 May 1983)			
1	*See* CEA-CONF-6817	DE84750440	MN -34	9:12892
CONF-830627-	(Conference on tracer kinetics and physiologic modeling - theory to practice, St. Louis, MO, USA, 6 Jun 1983)			
2	*See* CEA-CONF-6853	DE84750448	MN -48	9:12788
CONF-830638-	(2. national colloquium on electromagnetic compatibility, Tregastel, France, 1-3 Jun 1983)			
2	*See* CEA-CONF-6840	DE84750434	MN -80	9:11971
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22	*See* LBL-16972	DE84005198	MN -25	9:12358
CONF-830696-	(Operations Research Society of America conference on analytic techniques for energy planning, Washington, DC, USA, 7-8 Jun 1983)			
4	NTIS, PC A03/MF A01	DE84004419	MN -97c	9:12185
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1	*See* CEA-CONF-6802	DE84750431	MN -20g	9:12979
CONF-8306151-	(11. international symposium on cerebral blood flow and metabolism, Paris, France, 20-24 Jun 1983)			
1	*See* CEA-CONF-6844	DE84750436	MN -48	9:12785
2	*See* CEA-CONF-6851	DE84750438	MN -48	9:12787
3	*See* CEA-CONF-6843	DE84750447	MN -48	9:12784
4	*See* CEA-CONF-6842	DE84750452	MN -48	9:12783
5	*See* CEA-CONF-6841	DE84750453	MN -48	9:12782

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CONF-8306152-	(Workshop on fusion blanket technology, Erice, Italy, 6-10 Jun 1983)			
1	*See* CEA-CONF-6847	DE84750439	MN -20d	9:13014
2	*See* CEA-CONF-6848	DE84750458	MN -20d	9:13015
CONF-8306153-	(2. symposium on effects of aging on regulation of cerebral blood flow and metabolism, San-Remo, Italy, 30 Jun-1 Jul 1983)			
1	*See* CEA-CONF-6845	DE84750449	MN -48	9:12786
CONF-8306154-	(Meeting of the South-French working group in nuclear medicine, Nice, France, 7 Jun 1983)			
1	*See* CEA-CONF-6859	DE84750450	MN -48	9:12816
CONF-8306155-	(Meeting of the International Chemical Fertilizer Center, Uppsala, Sweden, 13-18 Jun 1983)			
1	*See* CEA-CONF-6852	DE84750451	MN -48	9:12810
CONF-8306156-	(Workshop on experimentation at HERA, Amsterdam, Netherlands, 9-11 Jun 1983)			
1	*See* LAL-RT-83-10	DE84750460	MN -28	9:12641
CONF-8306157-	(Meeting of the European working group on hot laboratories and remote handling, Petten, Netherlands, 8-10 Jun 1983)			
1	*See* CEA-CONF-6854	DE84750469	MN -78	9:11877
CONF-830710-	(7. international conference of radiation research, Amsterdam, Netherlands, 3-8 Jul 1983)			
11	*See* CEA-CONF-6871	DE84750433	MN -70	9:11587
CONF-830718-	(International Europhysics conference on high energy physics, Brighton, UK, 20-27 Jul 1983)			
15	*See* LAL-83-21	DE84750466	MN -34D	9:12903
CONF-830782-	(11. L. H. Gray conference on cellular repair of radiation damage - mechanisms and modifying agents, Glasgow, UK, 18-22 Jul 1983)			
3	*See* PNL-SA-11687	DE84005889	MN -48	9:12824
CONF-830789-	(7. congress of logic, methodology and philosophy of science, Salzburg, Austria, 11-16 Jul 1983)			
2	*See* SLAC-PUB-3259	DE84005425	MN -34	9:12972
CONF-830795-	(Symposium on energy removal and particle control and toroidal fusion devices, Princeton, NJ, USA, 26-29 Jul 1983)			
9	*See* PPPL-2057	DE84006282	STD -20a	9:13037
CONF-8307108-	(Meeting on biological processes and soil fertility, Reading, UK, 4-9 Jul 1983)			
1	*See* CEA-CONF-6935	DE84750456	MN -48	9:12811
CONF-8307109-	(11. SLAC summer institute conference on particle physics - dynamics and spectroscopy at high energy, Stanford, CA, USA, 18-29 Jul 1983)			
5	*See* SLAC-PUB-3260	DE84005423	MN -34D	9:12909
CONF-830801-	(8. information processing in medical imaging conference, Brussels, Belgium, 29 Aug-2 Sep 1983)			
2	*See* CEA-CONF-6909	DE84750454	MN -48	9:12789
CONF-830802-	(International Union of Theoritical and Applied Mechanics symposium on atmospheric disperation of heavy gases and small particles, Delft, Netherlands, 28 Aug-2 Sep 1983)			
1-Summ.	*See* UCRL-90150	DE84005210	MN -11	9:11538
CONF-830812-	(18. intersociety energy conversion engineering conference, Orlando, FL, USA, 21-26 Aug 1983)			
	Proc., Intersoc. Energy Convers. Eng. Conf., 2: 668-677(Aug 1983)			9:11846
	Proc., Intersoc. Energy Convers. Eng. Conf., 5: 2260-2265(Aug 1983)			9:11847
CONF-830814-	(186. national meeting of the American Chemical Society, Washington, DC, USA, 28 Aug-2 Sep 1983)			
10	*See* ENICO-1142	DE84005375	STD -4	9:12715
Vol.4	Prepr. Pap. - Am. Chem. Soc., Div. Fuel Chem., 28: No. 5, 17-25(1983)			9:11424
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Vol.4	Prepr. Pap. - Am. Chem. Soc., Div. Fuel Chem., 28: No. 5, 48-57(1983)			9:11441
CONF-830816-	(International meeting on light-water reactor severe accident evaluation, Cambridge, MA, USA, 28 Aug-1 Sep 1983)			
50	NTIS, PC A02/MF A01	DE84004382	MN -78	9:12017
51	NTIS, PC A02/MF A01; 1	DE84004384	MN -78	9:12018

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CONF-830817-	(SLAC summer institute on particle physics, Stanford, CA, USA, 16-27 Aug 1983)			
3	*See* LBL-16953	DE84004058	MN -34D	9:12906
CONF-830822-	(12. international conference on high energy accelerators, Batavia, IL, USA, 11-16 Aug 1983)			
45	*See* LAL-RT-83-11	DE84750459	MN -28	9:12642
46	*See* LAL-RT-83-13	DE84750461	MN -28	9:12594
47	*See* LAL-RT-83-12	DE84750462	MN -28	9:12643
50	NTIS, PC A02/MF A01	DE84005463	MN -21	9:12981
CONF-830841-	(Cryogenic engineering conference and international cryogenic materials conference, Colorado Springs, CO, USA, 15-19 Aug 1983)			
29	*See* LBL-16530	DE84005183	MN -25	9:12356
CONF-830897-	(NRC workshop on spent fuel/cladding reactions during dry storage, Gaithersburg, MD, USA, 17 Sep-18 Aug 1983)			
5	*See* PNL-SA-11125	DE84005607	MN -85	9:12361
CONF-8308101-	(International symposium on lepton and photon interactions at high energies, Ithaca, NY, USA, 4-9 Sep 1983)			
7	*See* LAL-83-22	DE84750467	MN -34D	9:12904
9	*See* SLAC-PUB-3250	DE84005327	MN -34D	9:12878
CONF-8308149-	(Conference on glass in planetary and geological phenomena, Alfred, NY, USA, 14-18 Aug 1983)			
2	*See* DP-MS-83-21	DE84005195	MN -70	9:12352
CONF-8308155-	(Workshop on energetic material initiation fundamentals, Chestertown, MD, USA, 15-17 Aug 1983)			
1	*See* LBL-16954	DE84005175	MN -4	9:12968
CONF-8309127-	(International Nuclear Target Society workshop, Argonne, IL, USA, 7-9 Sep 1983)			
6	NTIS, PC A02/MF A01	DE84005218	MN -28	9:12588
7	NTIS, PC A02/MF A01	DE84005414	MN -38	9:12931
CONF-8309170-	(Symposium on the use of nonstandard subsized specimens for irradiated testing, Albuquerque, NM, USA, 23 Sep 1983)			
6	*See* PNL-SA-11404	DE84005884	MN -25	9:12362
CONF-8309186-	(49. meeting of the Frence working group on dosimetry, Grenoble, France, 21-22 Sep 1983)			
1	*See* CEA-CONF-6818	DE84750468	MN -80	9:11950
CONF-831011-	(American Vacuum Society symposium, Boston, MA, USA, 31 Oct-4 Nov 1983)			
5	*See* LBL-16145	DE84005184	MN -20a	9:13004
CONF-831047-	(American Nuclear Society winter meeting, San Francisco, CA, USA, 30 Oct-4 Nov 1983)			
108	*See* EGG-M-13483	DE84003027	MN -78	9:12023
125	*See* HEDL-SA-2952-FP	DE84004826	MN -79	9:11983
CONF-831069-	(5. conference on atmospheric radiation, Baltimore, MD, USA, 31 Oct-3 Nov 1983)			
4	*See* SERI/TP-215-2049	DE84000018	STD -63	9:11741
CONF-831086-	(Electrochemical Society fall meeting, Washington, DC, USA, 9-14 Oct 1983)			
11	*See* SAND-83-2655C	DE84005529	MN -94cb	9:12106
CONF-8310129-	(American Society for Metals conference on copper and copper alloys, Philadelphia, PA, USA, 3-6 Oct 1983)			
2	NTIS, PC A02/MF A01	DE84004914	MN -79r	9:12348
CONF-8310143-	(11. NRC water reactor safety research information meeting, Gaithersburg, MD, USA, 14-24 Oct 1983)			
9	*See* LA-UR-83-2949	DE84001718	MN -78	9:12040
17	NTIS, PC A02/MF A01; 1	DE84002058	MN -80	9:12020
50	*See* PNL-SA-11651	DE84003354	MN -78	9:12074
69	*See* EGG-M-23783	DE84004231	MN -78	9:12027
70	*See* EGG-M-20983	DE84004353	MN -78	9:12026
CONF-8310178-	(2. international conference and workshop on radiative properties of hot dense matter, Sarasota, FL, USA, 31 Oct-4 Nov 1983)			
3	*See* SAND-83-1797C	DE84005519	MN -34	9:12961
CONF-8310205-	(TMS-AIME fall meeting, Philadelphia, PA, USA, 2-6 Oct 1983)			
4	NTIS, PC A02/MF A01	DE84004426	MN -25	9:12349
CONF-8310220-	(International specialty conference on the meteorology of acidic deposition, Hartford, CT, USA, 16-19 Oct 1983)			
2	NTIS, PC A02/MF A01	DE84003444	MN -11	9:12697
CONF-8310241-	(DOE/EPRI beta battery workshop, Washington, DC, USA, 18-20 Oct 1983)			
2	NTIS, PC A02/MF A01	DE84005216	MN -96	9:12101
CONF-8310246-	(NASA/Goddard-CDC symposium on CYBER 205 applications, Lanham, MD, USA, 11 Oct-12 Nov 1983)			
1	*See* LBL-16754	DE84005173	MN -4	9:12967
CONF-8310248-	(Symposium on national energy issues, Rockville, MD, USA, 19-21 Oct 1983)			
1	*See* EGG-M-26183	DE84005683	MN -80	9:12028
CONF-831111-	(ASME winter annual meeting, Boston, MA, USA, 13-18 Nov 1983)			
13	*See* EGG-M-26382	DE84005051	MN -78	9:12029
14	*See* EGG-M-15183	DE84005121	MN -80	9:12025
15	*See* EGG-M-14883	DE84005122	MN -78	9:12024
16	NTIS, PC A02/MF A01	DE84005123	MN -78	9:12019

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CONF-831174-	(Materials Research Society annual meeting, Boston, MA, USA, 14-17 Nov 1983)			
62	*See* DP-MS-83-61	DE84005192	MN -70	9:12353
63	*See* SAND-83-1451C	DE84005524	MN -70	9:11620
64	*See* SAND-83-1416C	DE84005527	MN -25	9:12390
65	*See* SAND-83-1516C	DE84005514	MN -70	9:11621
66	*See* LBL-16937	DE84005546	MN -25	9:12677
CONF-831180-	(3. international symposium on the production and neutralization of negative ions and beams, Upton, NY, USA, 14-18 Nov 1983)			
17	*See* LBL-16865	DE84003388	MN -20a	9:13035
CONF-831195-	(International congress on applications of lasers and electro-optics, Los Angeles, CA, USA, 14-17 Nov 1983)			
6	*See* EGG-M-22783	DE84005454	MN -38	9:12502
CONF-8311109-	(Direct coal liquefaction contractor's review conference, Pittsburgh, PA, USA, 16-17 Nov 1983)			
3	*See* DOE/FE/60181-21	DE84005436	MN -90d	9:11408
CONF-8311119-	(Pu isotopic and metals exchange meeting, Miamisburg, OH, USA, 2 Nov 1983)			
2	*See* UCRL-90157	DE84005207	MN -4	9:12403
CONF-8311128-	(Washington State Beekeepers Association meeting, Mt. Vernon, WA, USA, 2 Nov 1983)			
1	*See* PNL-SA-11774	DE84003260	MN -11	9:12706
CONF-8311130-	(International conference on fracture prevention in energy and transport systems, Rio de Janeiro, Brazil, 27 Nov-2 Dec 1983)			
2	*See* EGG-M-16983	DE84005481	MN -25	9:12354
CONF-8311133-	(11. DOE compatibility meeting, Livermore, CA, USA, 18-20 Nov 1983)			
1	*See* SAND-83-1457C	DE84005513	MN -25	9:12385
CONF-8311134-	(Workshop on the electrochemistry of zinc/halogen batteries, Palo Alto, CA, USA, 30 Nov-1 Dec 1983)			
1	*See* SAND-83-7467C	DE84005532	MN -94cb	9:12107
CONF-831203-	(10. symposium on fusion engineering, Philadelphia, PA, USA, 5-9 Dec 1983)			
70	NTIS, PC A02/MF A01	DE84004441	MN -20d	9:13017
75	*See* UCRL-89438	DE84004804	MN -20	9:13046
76	*See* DOE/ET/51013-105	DE84005076	STD -20	9:13030
77	*See* DOE/ET/51013-107	DE84004816	MN -20a	9:13031
78	*See* UCRL-89318	DE84005136	MN -20	9:13044
79	*See* EGG-M-10283	DE84005057	MN -20	9:12990
80	*See* EGG-M-10983	DE84005056	MN -20	9:13033
81	*See* EGG-M-10883	DE84004542	MN -20	9:13032
82	*See* UCRL-89371	DE84004806	MN -20	9:13045
85	NTIS, PC A02/MF A01	DE84004693	MN -20	9:13018
86	*See* UCRL-89192	DE84005432	MN -21	9:13043
87	NTIS, PC A02/MF A01	DE84005211	MN -20d	9:13019
88	NTIS, PC A02/MF A01	DE84005212	MN -20d	9:13020
89	NTIS, PC A02/MF A01	DE84005215	MN -20d	9:13021
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92	NTIS, PC A02/MF A01	DE84005263	MN -20b	9:13023
93	NTIS, PC A02/MF A01	DE84005264	MN -20b	9:13024
94	NTIS, PC A02/MF A01	DE84005262	MN -20b	9:13025
95	NTIS, PC A02/MF A01	DE84005261	MN -20b	9:13026
96	*See* UCRL-90054	DE84005213	MN -20	9:13048
CONF-831205-	(6. Miami international conference on alternative energy sources, Miami Beach, FL, USA, 12-14 Dec 1983)			
6	*See* UCRL-90036	DE84005133	MN -20	9:13047
CONF-831217-	(5. civilian radioactive waste management information meeting, Washington, DC, USA, 12-15 Dec 1983)			
3	*See* UCRL-90045	DE84005134	MN -70	9:11630
4	NTIS, PC A02/MF A01	DE84005296	MN -70	9:11589
5	NTIS, PC A02/MF A01; 1	DE84005297	MN -70	9:11568
6	NTIS, PC A02/MF A01	DE84005298	MN -70	9:11580
7	NTIS, PC A02/MF A01; 1	DE84005288	MN -70	9:11590
9	NTIS, PC A02/MF A01	DE84005286	MN -70	9:11642
11	NTIS, PC A02/MF A01; 1	DE84005289	MN -70	9:11591
13	NTIS, PC A02/MF A01	DE84005290	MN -70	9:11592
14	*See* RHO-BW-SA-327P	DE84006037	MN -70	9:11614
16	*See* RHO-BW-SA-330P	DE84006040	MN -70	9:11616
17	*See* RHO-BW-SA-332-P	DE84006041	MN -70	9:11617
18	*See* RHO-BW-SA-328P	DE84006034	MN -70	9:11615
19	*See* PNL-SA-11865	DE84005606	MN -70	9:11576
CONF-831239-	(Systems simulation symposium of fossil fuel conversion processes, Morgantown, WV, USA, 6-8 Dec 1983)			
4	NTIS, PC A02/MF A01	DE84005706	MN -90c	9:11402
5	NTIS, PC A02/MF A01; 1	DE84005415	MN -32	9:13070
CONF-831252-	(Royal Scientific Society conference, Amman, Jordan, 9-13 Dec 1983)			
1	NTIS, PC A02/MF A01	DE84003992	MN -59	9:11800
CONF-831253-	(9. workshop on geothermal reservoir engineering, Stanford, CA, USA, 13-15 Dec 1983)			
4	*See* EGG-M-23883	DE84005453	MN -66a	9:11810

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CONF-831255-	(IAEA specialists meeting on hydrogen behaviour and control and related containment loading aspects, Vienna, Austria, 12-16 Dec 1983)			
1	*See* LA-UR-83-3451	DE84003813	MN -78	9:12041
CONF-831260-	(Workshop on international cooperation in magnetic fusion, Washington, DC, USA, 14-15 Dec 1983)			
1	NTIS, PC AMF A01; 1	DE84004645	MN -20	9:13027
CONF-831261-	(International symposium on sister chromatic exchange, Upton, NY, USA, 4-8 Dec 1983)			
1	*See* UCRL-89891	DE84005433	MN -48	9:12863
CONF-831262-	(International congress of genetics, New Delhi, India, 12-21 Dec 1983)			
1	*See* BNL-34094	DE84005315	MN -48	9:12776
CONF-831264-	(Workshop on accelerator physics issues for a superconducting super collider, Ann Arbor, MI, USA, 12-17 Dec 1983)			
1	*See* FERMILAB-CONF-84/18	DE84005825	MN -28	9:12539
CONF-840112-	(IEEE Power Engineering Society winter meeting, Dallas, TX, USA, 29 Jan-3 Feb 1984)			
2	NTIS, PC A02/MF A01; 1	DE84005817	MN -60	9:11826
CONF-840113-	(Symposium on space nuclear power systems, Albuquerque, NM, USA, 10-13 Jan 1984)			
3	NTIS, PC A03/MF A01; 1	DE84005409	MN -38	9:11931
4	NTIS, PC A03/MF A01	DE84005539	MN -80	9:11932
CONF-840115-	(Instrumentation and measurement technology conference, Long Beach, CA, USA, 17-18 Jan 1984)			
1	*See* SAND-83-1493C	DE84005553	MN -32	9:13040
CONF-840116-	(63. annual meeting of Transportation Research Board, Washington, DC, USA, 16-20 Jan 1984)			
2	NTIS, PC A03/MF A01; 1	DE84005815	MN -71	9:11569
CONF-840124-	(American Society of Heating, Refrigerating and Air-Conditioning Engineers meeting, Atlanta, GA, USA, 29 Jan-1 Feb 1984)			
1	NTIS, PC A02/MF A01	DE84005816	MN -95d	9:12218
2	NTIS, PC A03/MF A01	DE84005813	MN -95d	9:12219
CONF-840138-	(American Production and Inventory Control Society specialty seminar, Palm Springs, CA, USA, 30 Jan-1 Feb 1984)			
1	*See* DP-MS-83-105	DE84005179	MN -32	9:13063
CONF-840140-	(International symposium on solid state physics under pressure, Izu-Nagaoka, Japan, 18-21 Jan 1984)			
1	*See* SAND-83-2567?C	DE84005724	MN -34	9:12965
CONF-840141-	(INMM seminar on spent fuel storage, Washington, DC, USA, 10-13 Jan 1984)			
1	*See* PNL-SA-11904	DE84005887	MN -85	9:11577
CONF-840201-	(ASME energy sources technology conference and exhibition, New Orleans, LA, USA, 12-16 Feb 1984)			
6	NTIS, PC A02/MF A01; 1	DE84004043	MN -64	9:11778
8	*See* DOE/FE/60181-25	DE84002665	MN -90	9:11409
CONF-840245-	(6. symposium on management of uranium mill tailings, low-level waste, and hazardous waste, Fort Collins, CO, USA, 1-3 Feb 1984)			
2	*See* PNL-SA-11652	DE84005890	MN -70A	9:11646
CONF-840307-	(Waste management '84, Tucson, AZ, USA, 11-15 Mar 1984)			
1	*See* UCRL-89820	DE84001431	MN -70	9:11629
CONF-840367-	(4. capacitor and resistor technology symposium (CARTS '84), Orlando, FL, USA, 6-8 Mar 1984)			
1	*See* LA-UR-83-3634	DE84004312	MN -38	9:12095
CONF-840368-	(American Concrete Institute annual conference, Phoenix, AZ, USA, 1 Mar 1984)			
1	*See* HEDL-SA-3018FP	DE84004950	MN -25	9:12458
CONF-840369-	(17. annual simulation symposium, Tampa, FL, USA, 14-16 Mar 1984)			
1	*See* HEDL-SA-2626-FP	DE84003791	MN -71	9:11573
CONF-840371-	(International conference on acoustics, speech and signal processing, San Diego, CA, USA, 19-21 Mar 1984)			
1	*See* SAND-83-2665C	DE84005521	MN -38	9:12517
2	*See* SAND-83-1863C	DE84005550	MN -38	9:12516
CONF-840373-	(IADC drilling technology conference, Dallas, TX, USA, 19-21 Mar 1984)			
1-Draft	*See* SAND-83-1755C	DE84005723	MN -92a	9:11494
CONF-840494-	(Topical meeting on optical fabrication and testing, Monterey, CA, USA, 18-20 Apr 1984)			
1	*See* UCRL-90218	DE84005865	MN -25	9:12392
CONF-840926-	(5. international conference on pressure vessel technology, San Francisco, CA, USA, 9-14 Sep 1984)			
1	*See* HEDL-SA-2850	DE84003988	MN -79k	9:11924
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DOE/CS/65001-T2	NTIS, PC A02/MF A01	DE84005703	MN -95d	9:12228
DOE/CS/66001-1	NTIS, PC A03/MF A01	DE84005796	STD -61a	9:11723
2	NTIS, PC A02/MF A01	DE84005746	STD -95f	9:12407
3	NTIS, PC A03/MF A01	DE84005745	STD -61a	9:12200
DOE/CS/83103-T1	NTIS, PC A02/MF A01	DE84005236	MN -4	9:12408
DOE/CS/83106-T1	NTIS, PC A02/MF A01; 1	DE84005234	MN -63	9:11724
DOE/CS/83109-T2	NTIS, PC A04/MF A01; 1	DE84005471	MN -25	9:12388
DOE/CS/83110-T1	NTIS, PC A02/MF A01	DE84005233	MN -63	9:11725
T2	NTIS, PC A02/MF A01	DE84005235	MN -25	9:12671
DOE/CS/83114-T1	NTIS, PC A02/MF A01	DE84005247	MN -63	9:11726
DOE/CS/84051-T1	NTIS, PC A03/MF A01; 1	DE84005280	MN -4	9:12409
T2	NTIS, PC A03/MF A01	DE84005470	MN -4	9:12410
DOE/CS/84062-1	NTIS, PC A02/MF A01; 1	DE84005248	MN -94cc	9:12102
DOE/CS/84063-1	NTIS, PC A02/MF A01; 1	DE84005275	MN -61c	9:11727
DOE/CS/89002-T1	NTIS, PC A05/MF A01; 1	DE84005708	MN -60	9:11827
DOE/CS/90215-T1	NTIS, PC A05/MF A01	DE83017893	STD -95f	9:12263
DOE/DP/40163-2	NTIS, PC A02/MF A01; 1	DE84005319	MN -21	9:12982

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DOE/EA-				
0196	NTIS, PC A07/MF A01; 1	DE84005456	MN -90i	9:11446
DOE/EIA-				
0226(83/ 10)	NTIS, PC A03/MF A01 - GPO	DE84005451	MN -98E	9:12186
0323(81)	NTIS, PC A15/MF A01 - GPO	DE84006235	MN -98E	9:12187
0370(83)	NTIS, PC A99/MF A01 - GPO	DE84005390	MN -98	9:12167
0380(83/ 12-1)	NTIS, PC A05/MF A01 - GPO	DE84005093	MN -98B	9:11514
0439(83)	NTIS, PC A04/MF A01; 1 - GPO	DE84004380	MN -98	9:12152
DOE/ER-				
0186	NTIS, PC A02/MF A01	DE84005461	STD -11	9:12129
0187	NTIS, PC A03/MF A01	DE84006219	STD -11	9:12130
0188	NTIS, PC A03/MF A01	DE84006221	STD -11	9:12698
DOE/ER/01195-				
489	NTIS, PC A08/MF A01	DE84005484	MN -34D	9:12896
490	NTIS, PC A11/MF A01; 1	DE84005492	MN -34D	9:12897
T4	NTIS, PC A11/MF A01; 1	DE84005489	MN -34D	9:12898
DOE/ER/01545-				
342	NTIS, PC A02/MF A01	DE84005079	MN -34D	9:12910
DOE/ER/02029-				
T4	NTIS PC A02/MF A01	DE84003219	MN -25	9:12501
DOE/ER/02718-				
11	NTIS, PC A02/MF A01	DE84005392	MN -34A	9:12887
DOE/ER/02960-				
T2	NTIS, PC A03/MF A01; 1	DE84005485	MN -25	9:12420
DOE/ER/02978-				
10	NTIS, PC A02/MF A01; 1	DE84005666	MN -34D	9:12919
DOE/ER/04014-				
13	NTIS, PC A03/MF A01	DE84005142	MN -80	9:11981
DOE/ER/04967-				
T1	NTIS MF A01; 2	DE84005429	MN -48	9:12755
DOE/ER/05002-				
38	NTIS, PC A02/MF A01	DE84005493	MN -25	9:12350
DOE/ER/06036-				
T2	NTIS, PC A03/MF A01	DE84005178	MN -34A	9:12888
DOE/ER/10044-				
1	NTIS, PC A03/MF A01	DE84005067	MN -13	9:12299
DOE/ER/10386-				
T1	NTIS, PC A02/MF A01	DE84005807	MN -38	9:12528
DOE/ER/10399-				
T1	NTIS, PC A02/MF A01	DE84005475	MN -4	9:11681
DOE/ER/10473-				
T2	NTIS, PC A02/MF A01	DE84004198	MN -32	9:13071
DOE/ER/10540-				
T1	NTIS, PC A02/MF A01; 1	DE84005242	MN -61c	9:12423
DOE/ER/10693-				
T1	NTIS MF A01; 2	DE84005685	MN -38	9:12440
DOE/ER/10866-				
T3	NTIS, PC A02/MF A01	DE84004304	MN -34	9:12964
DOE/ER/12039-				
1	NTIS, PC A02/MF A01	DE84003947	MN -61c	9:12424
DOE/ER/12094-				
T1	NTIS, PC A02/MF A01; 1	DE84005252	MN -25	9:12389
DOE/ER/13077-				
1	NTIS, PC A02/MF A01	DE84004469	MN -48	9:12756
DOE/ER/14953-				
4	NTIS, PC A02/MF A01	DE84005806	MN -4	9:12439
DOE/ER/52069-				
T1	NTIS, PC A03/MF A01; 1	DE84002237	MN -20b	9:12457
DOE/ER/53140-				
12	NTIS, PC A03/MF A01	DE84005808	MN -20g	9:12983
DOE/ER/53154-				
61	NTIS, PC A04/MF A01	DE84005052	STD -20f	9:12984
DOE/ET/00079-				
T1	NTIS, PC A04/MF A01; 1	DE84005237	MN -61	9:11696
DOE/ET/00087-				
T1	NTIS, PC A05/MF A01	DE84005238	MN -61a	9:11690
DOE/ET/10069-				
T32	NTIS (US Sales Only), PC A19/MF A01; 1	DE83013797	STD -90d	9:11403
T80	NTIS (US Sales Only), PC A14/MF A01; 1	DE84005843	STD -90d	9:11404
DOE/ET/10143-				
10-Rev.	NTIS MF A01; 2	DE83012513	STD -90d	9:11405
DOE/ET/13053-				
T1	NTIS, PC A02/MF A01	DE84005729	MN -89	9:11447
T2	NTIS, PC A02/MF A01	DE84005731	MN -89	9:11448
T3	NTIS, PC A02/MF A01	DE84005726	MN -89	9:11449
T4	NTIS, PC A02/MF A01	DE84005732	MN -89	9:11450
T5	NTIS, PC A02/MF A01	DE84005728	MN -89	9:11451
DOE/ET/13800-				
4	NTIS, PC A07/MF A01; 1	DE84004470	STD -90d	9:11406
DOE/ET/14880-				
17	NTIS, PC A03/MF A01; 1	DE84005491	MN -90d	9:11407
DOE/ET/15303-				
T7	NTIS, PC A07/MF A01; 1	DE84005068	STD -96	9:12319
DOE/ET/15366-				
T3	NTIS, PC A10/MF A01; 1	DE84005477	MN -93	9:12208

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DOE/ET/15490-1361	NTIS, PC A04/MF A01; 1	DE83007107	STD -90e	9:12529
DOE/ET/20356-8	NTIS, PC A06/MF A01	DE84005609	STD -63	9:11756
DOE/ET/21055-T3	NTIS, PC A05/MF A01; 1	DE83015170	MN -64	9:11779
DOE/ET/29213-T1	NTIS, PC A05/MF A01	DE84005473	MN -97	9:12188
T2	NTIS, PC A05/MF A01; 1	DE84005472	MN -97	9:12189
DOE/ET/29361-1	NTIS, PC A02; 3	DE84005459	MN -97	9:11839
DOE/ET/34006-10	NTIS (US Sales Only), PC A05/MF A01	DE84006223	STD -78	9:11871
DOE/ET/34014-12	NTIS (US Sales Only), PC A03/MF A01	DE84003661	STD -78	9:11894
DOE/ET/34031-12	NTIS (US Sales Only), PC A05/MF A01	DE84004200	STD -78	9:11872
DOE/ET/37240-104TR	NTIS, PC A04/MF A01; 1	DE84004538	MN -79	9:11918
DOE/ET/51013-93	NTIS, PC A03/MF A01	DE84003360	STD -20	9:12985
105	NTIS, PC A02/MF A01	DE84005076	STD -20	9:13030
107	NTIS, PC A03/MF A01	DE84004816	MN -20a	9:13031
T2	NTIS, PC A05/MF A01; 1	DE84004244	MN -20g	9:12986
DOE/ET/53052-T1	NTIS, PC A04/MF A01	DE84005664	MN -20	9:12987
DOE/ET/53088-113	NTIS, PC A03/MF A01	DE84005450	MN -20g	9:12988
117	NTIS, PC A06/MF A01	DE84005385	MN -20g	9:12989
DOE/EV/10327-2	NTIS, PC A02/MF A01; 1	DE84005770	MN -48	9:12757
DOE/EV/10610-3	NTIS, PC A03/MF A01; 1	DE84005663	MN -11	9:12733
DOE/EV/10694-9	NTIS, PC A02/MF A01	DE84005449	MN -11	9:12739
DOE/EV/70040-27	NTIS, PC A02/MF A01	DE84005642	MN -11	9:12734
DOE/FE/60181-21	NTIS, PC A02/MF A01	DE84005436	MN -90d	9:11408
25	NTIS, PC A03/MF A01	DE84002665	MN -90	9:11409
DOE/ID/12151-2	NTIS MF A01; 2	DE84005416	MN -48	9:12790
DOE/ID/12239-T1	NTIS MF A01; 2	DE84005486	MN -95d	9:12264
DOE/ID/12476-T1	NTIS, PC A02/MF A01; 1	DE84005710	MN -70B	9:11594
DOE/JPL-1012-90	NTIS, PC A03/MF A01	DE84005747	STD -63b	9:11728
DOE/JPL/1012-91	NTIS, PC A04/MF A01	DE84005612	STD -63b	9:11729
93	NTIS, PC A02/MF A01	DE84005741	STD -63b	9:11714
DOE/JPL/1060-63	NTIS, PC A03/MF A01	DE84005610	STD -62	9:11760
DOE/JPL/955089-83/ 17	NTIS, PC A02/MF A01	DE84005864	STD -63b	9:11730
DOE/JPL/955843-84/ 12	NTIS, PC A04/MF A01	DE84006049	STD -63b	9:11731
DOE/LLW-27T	NTIS MF A01; 2	DE84005422	STD -70B	9:11595
DOE/MA-0142	NTIS, PC A03/MF A01	DE84006269	MN -13	9:13059
DOE/MI/01000-T1	NTIS, PC A04/MF A01	DE84006142	MN -13	9:13060
T2	NTIS, PC A07/MF A01	DE84005730	MN -13	9:13061
DOE/MI/10023-T2	NTIS, PC A02/MF A01	DE84005468	MN -13	9:12126
DOE/NASA/0168-6	NTIS, PC A02/MF A01	DE84005661	MN -96	9:12320
DOE/NASA/51040-51	NTIS, PC A03/MF A01	DE84005871	STD -96	9:12321
DOE/NBM-4004243	Renewable Energy Inst. 2010 Massachusetts Ave., N.W. Washington, D.C. 20036		ND -98D	9:12201
4005278	NTIS, PC A04/MF A01	DE84005278	MN -97e	9:12190
4005279	NTIS MF A01; 2 - GPO $1.00	DE84005279	MN -97	9:11840
4005684	NTIS, PC A02/MF A01	DE84005684	MN -25	9:12351
4005844	NTIS, PC A08/MF A01; 1	DE84005844	MN -95	9:12300
4005846	NTIS, PC A04/MF A01	DE84005846	MN -95	9:12301
DOE/NE/37254-2	NTIS, PC A12/MF A01; 1	DE84005465	MN -79p	9:12021
DOE/PC/30013-T3	NTIS, PC A10/MF A01	DE84005495	STD -90a	9:11438
DOE/PC/30223-10	NTIS, PC A06/MF A01; 1	DE84004897	STD -90a	9:11439

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DOE/PC/30303-5	NTIS, PC A05/MF A01	DE84005830	STD -90e	9:12513
DOE/PC/30306-12	NTIS, PC A08/MF A01	DE84005662	STD -90i	9:11475
DOE/PC/40796-8	NTIS, PC A02/MF A01; 1	DE84005681	MN -90e	9:12521
DOE/PC/50257-4	NTIS, PC A03/MF A01	DE84003386	STD -90e	9:12522
DOE/PC/51260-4	NTIS, PC A03/MF A01	DE84004708	STD -90i	9:11452
DOE/PC/52274-T4	NTIS, PC A22/MF A01; 1	DE84004872	STD -88	9:11457
DOE/PC/60047-T1	NTIS, PC A02/MF A01; 1	DE84004752	MN -90d	9:11410
DOE/PC/60787-1	NTIS, PC A02/MF A01	DE84005400	MN -90d	9:11411
DOE/PC/60798-1	NTIS, PC A02/MF A01	DE84005636	MN -90a	9:11412
DOE/PC/62999-1	NTIS, PC A02/MF A01	DE84005641	MN -90a	9:11483
DOE/PE-0047	NTIS, PC A03/MF A01	DE84006268	MN -97	9:12191
DOE/PETC/TR-84/2	NTIS, PC A03/MF A01	DE84006050	STD -90c	9:11476
84/3	NTIS, PC A06/MF A01; 1	DE84006051	STD -90a	9:12399
DOE/R4/10163-T1	NTIS, PC A02/MF A01	DE84000329	MN -60	9:11828
DOE/R4/10193-T3	NTIS, PC A09/MF A01	DE84005851	MN -92a	9:11548
DOE/R4/10195-T1	NTIS, PC A12/MF A01	DE84005418	MN -92a	9:11543
DOE/R4/10200-T2	NTIS, PC A04/MF A01	DE84005850	MN -92a	9:11541
T3	NTIS, PC A02/MF A01	DE84005849	MN -92a	9:11542
DOE/R4/10309-T1	NTIS, PC A02/MF A01	DE84000322	MN -96	9:12253
DOE/R4/10311-T1	NTIS, PC A02/MF A01	DE84000769	MN -61a	9:11691
DOE/R4/10333-T2	NTIS, PC A04/MF A01	DE84005952	MN -92	9:11458
DOE/R4/10336-T1	NTIS, PC A05/MF A01; 1	DE84005421	MN -92a	9:11459
DOE/R4/10371-T2	NTIS, PC A04/MF A01	DE84005848	MN -92a	9:11460
T3	NTIS, PC A05/MF A01; 1	DE84005854	MN -92a	9:11461
DOE/R4/10400-T1	NTIS, PC A04/MF A01; 1	DE84005556	MN -92a	9:11531
DOE/R4/10431-T1	NTIS, PC A05/MF A01	DE84005953	MN -92a	9:11462
DOE/R4/10453-T1	NTIS, PC A02/MF A01	DE84000796	MN -95d	9:12229
DOE/R4/20006-T54	NTIS, PC A07/MF A01	DE84005509	MN -97e	9:11703
T55	NTIS, PC A02/MF A01	DE84005510	MN -97e	9:11704
T56	NTIS, PC A02/MF A01	DE84005557	MN -97e	9:11705
T57	NTIS, PC A02/MF A01	DE84005508	MN -97e	9:11706
T58	NTIS, PC A02/MF A01	DE84005512	MN -97e	9:11707
T59	NTIS, PC A02/MF A01	DE84005511	MN -97e	9:11708
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T3	NTIS, PC A04/MF A01	DE84005901	MN -98F	9:12194
T4	NTIS, PC A06/MF A01	DE84005898	MN -98F	9:12156
T5	NTIS, PC A06/MF A01; 1	DE84005902	MN -98E	9:12195
T6	NTIS, PC A05/MF A01; 1	DE84005900	MN -98F	9:12196
T7	NTIS, PC A06/MF A01	DE84005899	MN -98F	9:12157
DOE/RW-82.085	*See* AERE-M-3255	DE83703913	MN -70	9:11583
0001	NTIS, PC A12/MF A01	DE84005460	MN -70	9:11655
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T21	NTIS, PC A03/MF A01; 1	DE84005633	MN -48	9:12808

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T25	NTIS, PC A02/MF A01	DE84005841	MN -28	9:12563
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T25-Vol.1	NTIS, PC A12/MF A01; 1	DE84004808	STD -79h	9:11919
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T25-Vol.4	NTIS, PC A10/MF A01; 1	DE84004811	STD -79h	9:11921
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003	NTIS, PC A18/MF A01; 1	DE84004788	MN -58b	9:11761
137	NTIS, PC A02/MF A01; 1	DE84004535	MN -58c	9:11762
138	NTIS, PC A02/MF A01	DE84004536	MN -58c	9:11763
139	NTIS, PC A02/MF A01	DE84004786	MN -58c	9:11764
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T1	NTIS, PC A08/MF A01; 1	DE84004781	STD -66f	9:11815
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T15	NTIS, PC A02/MF A01	DE84005575	MN -4	9:11986
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T1	NTIS, PC A02/MF A01	DE84005359	MN -13	9:13062
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83-21	NTIS, PC A03/MF A01	DE84005195	MN -70	9:12352
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64-1-3	NTIS, PC A02/MF A01; 1	DE84005576	MN -4	9:11996
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60-228	NTIS MF A01; 2	DE84005573	MN -4	9:11997
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63-185	NTIS, PC A02/MF A01; 1	DE84005585	MN -4	9:11999
65-130	NTIS, PC A02/MF A01; 1	DE84005584	MN -4	9:12000
65-311	NTIS, PC A02; 3	DE84005571	MN -4	9:12001
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EAS/E-				
2/ 80	*See* IEA/CREAS-84/05			9:11535
4/ 82	*See* IEA/CREAS-84/02			9:11534
ECN-				
83-140	ECN, P.O. Box 1, 1755 ZG Petten, Netherlands		ND -60	9:11829
83-167	ECN, P.O. Box 1, 1755 ZG Petten, Netherlands		ND -60	9:11830
83-169	ECN, P.O. Box 1, 1755 ZG Petten, Netherlands		ND -60	9:11831
EFI-				
518(5) -82	NTIS (US Sales Only), PC A02/MF A01	DE83704368	MN -32	9:12899
523(10) -82	NTIS (US Sales Only), PC A02/MF A01	DE83704334	MN -28	9:12538

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EGG-				
2268	NTIS PC E07/MF $7.75	DE84005827	MN -70	9:11571
2285	*See* NUREG/CR-3557	DE84004664	MN -80	9:11973
EGG-IS-				
6511	NTIS, PC A04/MF A01; 1	DE84005482	MN -32	9:13072
EGG-M-				
10283	NTIS, PC A02/MF A01	DE84005057	MN -20	9:12990
10883	NTIS, PC A02/MF A01	DE84004542	MN -20	9:13032
10983	NTIS, PC A02/MF A01	DE84005056	MN -20	9:13033
13483	NTIS, PC A02/MF A01	DE84003027	MN -78	9:12023
14883	NTIS, PC A02/MF A01	DE84005122	MN -78	9:12024
15183	NTIS, PC A02/MF A01	DE84005121	MN -80	9:12025
16983	NTIS, PC A02/MF A01; 1	DE84005481	MN -25	9:12354
20983	NTIS, PC A02/MF A01	DE84004353	MN -78	9:12026
22783	NTIS, PC A02/MF A01	DE84005454	MN -38	9:12502
23783	NTIS, PC A02/MF A01; 1	DE84004231	MN -78	9:12027
23883	NTIS, PC A02/MF A01; 1	DE84005453	MN -66a	9:11810
26183	NTIS, PC A02/MF A01; 1	DE84005683	MN -80	9:12028
26382	NTIS, PC A02/MF A01	DE84005051	MN -78	9:12029
EGG-MS-				
6411	NTIS, PC A03/MF A01	DE84005464	MN -80	9:11977
EGG-TFBP-				
6399	NTIS, PC A05/MF A01	DE84005030	MN -78	9:12030
ENEA-RT/FARE-SIN-				
83-2	NTIS (US Sales Only), PC A03/MF A01; 1	DE84900246	MN -61a	9:11682
ENICO-				
1142	NTIS, PC A02/MF A01	DE84005375	STD -4	9:12715
EPA-				
450/ 3-80-003b	NTIS, PC A04/MF A01	DE84900819	MN -11	9:12752
450/ 3-83-005a	NTIS, PC A18/MF A01		MN -11	9:12749
460/ 3-83-009	*See* PB-84-104702			9:11685
600/ 4-83-045	*See* PB-84-120351			9:11550
EPRI-NP-				
3268	*See* NUREG/CR-3314	DE84900702	MN -78	9:12065
ERATL-				
83/ 32	NTIS PC $690.00			9:12514
83/ 33	NTIS			9:12231
ESC-				
23	NTIS (US Sales Only), PC A08/MF A01; 1	DE84750756	MN -98	9:12123
ESC-WR-				
83-23	ECN, P.O. Box 1, 1755 ZG Petten, Netherlands		ND -58	9:11710
EUR-				
7541-FR	*See* PB-84-121185			9:11738
7789-EN	*See* PB-84-119841			9:12402
7917	NTIS (US Sales Only), PC A02/MF A01	DE83703921	MN -2	9:12153
7936	NTIS (US Sales Only), PC A06/MF A01	DE83703889	MN -78	9:11563
7986-EN	*See* PB-84-119411			9:11556
8192-FR	*See* PB-84-121235			9:11673
8241/ 1-FR	*See* PB-83-252684			9:11809
8251-FR	*See* PB-84-119338			9:11654
EUR-CEA-FC-				
1176	NTIS (US Sales Only), PC A02/MF A01	DE84750414	MN -20g	9:12991
1180	NTIS (US Sales Only), PC A03/MF A01	DE84750412	MN -20g	9:12992
1181	NTIS (US Sales Only), PC A03/MF A01	DE84750409	MN -20g	9:12993
1182	NTIS (US Sales Only), MF A01; 2	DE84750410	MN -20g	9:12994
1186	NTIS (US Sales Only), PC A03/MF A01	DE84750411	MN -20a	9:12995
1187	NTIS (US Sales Only), PC A05/MF A01; 1	DE84750413	MN -20f	9:12996
1191	NTIS (US Sales Only), PC A03/MF A01	DE84750415	MN -20g	9:12997
1193	NTIS (US Sales Only), PC A02/MF A01	DE84750485	MN -20a	9:12998
1194	NTIS (US Sales Only), PC A02/MF A01	DE84750484	MN -20f	9:12999
1196	NTIS (US Sales Only), PC A03/MF A01	DE84750483	MN -20f	9:13000
EUR-CEA-FC-RA-				
1982	NTIS (US Sales Only), PC A05/MF A01; 1	DE84750416	MN -20	9:13001
FE-				
2893-104	*See* DOE/ET/10069-T32	DE83013797	STD -90d	9:11403
2893-123	*See* DOE/ET/10069-T80	DE84005843	STD -90d	9:11404
FEI-				
1343	NTIS (US Sales Only), PC A02/MF A01	DE83704341	MN -80	9:11955
FEMA-				
51	*See* NUREG-0981	DE84900726	MN -80	9:12052
FERMILAB-CONF-				
84/ 18	NTIS, PC A02/MF A01; 1	DE84005825	MN -28	9:12539
FERMILAB/TM-				
1222	NTIS, PC A02/MF A01; 1	DE84005821	MN -2	9:12589
1229	NTIS, PC A02/MF A01; 1	DE84005822	MN -28	9:12590
FRNC-TH-				
1104	NTIS (US Sales Only), PC A08/MF A01	DE83704240	MN -80	9:11972
1109	NTIS (US Sales Only), PC A08/MF A01	DE83704237	MN -78	9:11895
1114	NTIS (US Sales Only), PC A06/MF A01	DE83704236	MN -80	9:11956
1116	NTIS (US Sales Only), PC A07/MF A01	DE83704228	MN -41	9:12962
1132	NTIS (US Sales Only), PC A11/MF A01	DE83704238	MN -79	9:11922
1135	NTIS (US Sales Only), PC A07/MF A01	DE83704233	MN -38	9:12441
1138	NTIS (US Sales Only), PC A08/MF A01	DE83704235	MN -25	9:12503
1140	NTIS (US Sales Only), PC A12/MF A01	DE83704241	MN -80	9:11896
1142	NTIS (US Sales Only), PC A06/MF A01	DE83704239	MN -79	9:11923

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1164	NTIS (US Sales Only), PC A05/MF A01; 1	DE84750423	MN -28	9:12564
1166	NTIS (US Sales Only), PC A09/MF A01; 1	DE84750417	MN -34B	9:12875
1263	NTIS (US Sales Only), MF A01; 2	DE84750422	MN -34C	9:12943
1302	NTIS (US Sales Only), PC A07/MF A01; 1	DE84750420	MN -34C	9:12947
1303	NTIS (US Sales Only), PC A06/MF A01; 1	DE84750418	MN -34C	9:12945
1304	NTIS (US Sales Only), PC A05/MF A01; 1	DE84750419	MN -34C	9:12932
1386	NTIS (US Sales Only), PC A10/MF A01; 1	DE84750463	MN -34B	9:12876
FWS/OBS-				
82/ 65	Minerals Management Service, Dept of the Interior, Washington, DC 20240		MN -11	9:12731
83/ 01	Information Transfer Specialist, US Fish and Wildlife Service, NASA, 1010 Gausa Blvd., Slidell, LA 70458		MN -11	9:12732
GA-A-				
16233	NTIS, PC A05/MF A01	DE84005675	MN -23	9:11669
16240	NTIS, PC A02/MF A01	DE84005384	MN -20a	9:13002
16250	NTIS, PC A02/MF A01	DE84005386	MN -20a	9:13003
16757	NTIS, PC A04/MF A01	DE84006217	STD -77	9:11911
16874	NTIS, PC A05/MF A01	DE84005332	STD -20c	9:13034
17337	NTIS, PC A02/MF A01	DE84005638	MN -77	9:11912
GAO/AFMD-				
83-98	US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760		MN -92a	9:12168
GAO/NSIAD-				
84-4	US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760		MN -98B	9:12169
GAO/OGC-				
83-11	US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760		MN -92a	9:12113
GAO/PLRD-				
83-69	US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760		MN -95	9:12170
GAO/RCED-				
83-30	US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760		MN -92a	9:12171
83-120	US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760		MN -58a	9:12203
83-123	US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760		MN -98E	9:12114
83-128	US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760		MN -86	9:11656
83-135	US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760		MN -98B	9:12172
83-139	US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760		MN -92	9:12173
83-140	US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760		MN -98C	9:12174
83-141	General Accounting Office, Document Handlings and Information Service Facility, P.O. Box 6015, Gaithersburg, MD 20760		MN -15	9:12031
83-156	US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760		MN -98B	9:12175
83-192	US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760		MN -66f	9:12145
83-193	US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760		MN -98E	9:12115
83-200	General Accounting Office, PO Box 6015, Gaithersburg, MD 20760		MN -69	9:12131
83-237	US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760		MN -92	9:12176
83-241	US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760		MN -69	9:12132
84-11	US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760		MN -92a	9:12177
84-13	US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760		MN -22	9:12116
84-15	US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760		MN -2	9:12117
84-18	US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760		MN -22	9:12118
84-19	US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760		MN -92a	9:12178
84-24	US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760		MN -13	9:12162
84-25	US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760		MN -97	9:12119
84-28	US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760		MN -13	9:12163
84-32	US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760		MN -90c	9:12120
84-36	US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760		MN -96	9:12204
84-38	US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760		MN -97	9:12197
84-39	US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760		MN -13	9:12121

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84-59	US General Accounting Office, PO Box 6015, Gaithersburg, MD 20760		MN -90c	9:12179
GEAP-				
30083	*See* DOE/ET/34031-12	DE84004200	STD -78	9:11872
30245	NTIS (US Sales Only), PC A06/MF A01; 1	DE84005882	STD -78	9:11873
GEND-				
038	NTIS, PC A03/MF A01	DE84006260	MN -78	9:12032
GEND-INF-				
023-Vol.3	NTIS, PC A04/MF A01	DE84004115	MN -78	9:12033
041	NTIS, PC A03/MF A01	DE84004468	MN -78	9:12034
042	NTIS, PC A04/MF A01	DE84004114	MN -78	9:12035
GJBX-				
11(83)	NTIS, PC A21/MF A01; 1	DE84004972	MN -51	9:11551
11(83) App.1	NTIS, PC A99/MF A01; 1	DE84004971	MN -51	9:11552
39(83)	NTIS PC E05/MF $5.75	DE84005352	MN -51	9:11555
GKSS-				
83/ E/ 22	NTIS (US Sales Only), PC A05/MF A01	DE84750076	MN -38	9:12526
GL-				
3598	*See* AD-A-131720/5			9:12673
GSF-A-				
3/ 83	Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.)		ND -48	9:12855
HDL-TR-				
1995	*See* AD-A-131631/4			9:12974
HEDL-				
7376	NTIS, PC A06/MF A01	DE84005300	MN -70	9:11572
7412	NTIS, PC A02/MF A01	DE84004389	MN -20c	9:12355
HEDL-SA-				
2626-FP	NTIS, PC A02/MF A01	DE84003791	MN -71	9:11573
2850	NTIS, PC A03/MF A01	DE84003988	MN -79k	9:11924
2884	NTIS, PC A02/MF A01; 1	DE84001457	MN -78	9:12036
2952-FP	NTIS, PC A02/MF A01	DE84004826	MN -79	9:11983
3018FP	NTIS, PC A02/MF A01	DE84004950	MN -25	9:12458
HEDL-TC-				
2353-2	NTIS, PC A03/MF A01	DE84005299	MN -85	9:11603
HEDL-TME-				
83-32	NTIS, PC A03/MF A01	DE84006276	STD -85	9:11574
IAE-				
3558/ 5	NTIS (US Sales Only), PC A04/MF A01	DE83703883	MN -80	9:11897
3576/ 5	NTIS (US Sales Only), PC A02/MF A01	DE83703890	MN -78	9:11957
IAEA-TC-				
389/ 6-7	NTIS (US Sales Only), PC A02/MF A01	DE83704356	MN -37	9:11913
389/ 6-9	NTIS (US Sales Only), PC A02/MF A01	DE83704351	MN -37	9:12654
389/ 6-22	NTIS (US Sales Only), PC A02/MF A01	DE83704350	MN -77	9:11914
IEA/CREAS-				
84/ 02	NTIS PC $90.00			9:11534
84/ 05	NTIS$144.00			9:11535
IFSR-				
113	*See* DOE/ET/53088-113	DE84005450	MN -20g	9:12988
117	*See* DOE/ET/53088-117	DE84005385	MN -20g	9:12989
IFVE-OEA-ONF-				
82-16	NTIS (US Sales Only), PC A02/MF A01	DE83704168	MN -37	9:12655
ILLDOE-				
81/ 35	Illinois Dept. of Energy and Natural Resources, Rm. 300, 325 W. Adams St., Springfield, IL 62670		MN -95	9:12232
ILR-MITT-				
111	Fachinformationszentrum Energie, Physik, Mathematik, Karlsruhe (Germany, F.R.)			9:11842
INIS-mf-				
8202	NTIS (US Sales Only), PC A04/MF A01	DE83704231	MN -48	9:12792
8205	NTIS (US Sales Only), PC A02/MF A01	DE83704227	MN -41	9:11604
8208	NTIS (US Sales Only), PC A02/MF A01	DE83704243	MN -2	9:11866
8209	NTIS (US Sales Only), PC A02/MF A01	DE83704242	MN -2	9:11933
8214	NTIS (US Sales Only), PC A06/MF A01	DE83704229	MN -48	9:12793
8215	NTIS (US Sales Only), PC A07/MF A01	DE83704230	MN -48	9:12794
8217	NTIS (US Sales Only), PC A04/MF A01	DE83704232	MN -48	9:12795
8558	NTIS (US Sales Only), PC A03/MF A01	DE84780059	MN -41	9:11867
8578	NTIS (US Sales Only), PC A07/MF A01	DE83704244	MN -2	9:11868
8581	NTIS (US Sales Only), PC A07/MF A01	DE83704234	MN -28	9:12565
8641	NTIS (US Sales Only), PC A06/MF A01	DE84780084	MN -48	9:12818
INPE-				
2473	NTIS (US Sales Only), PC A02/MF A01	DE83703866	MN -34B	9:12716
INS-P-				
157	NTIS (US Sales Only), PC A02/MF A01	DE83704369	MN -32	9:12657
INS-R-				
285	NTIS (US Sales Only), PC A05/MF A01	DE83704371	MN -2	9:12924
286	NTIS (US Sales Only), PC A05/MF A01	DE83704372	MN -2	9:12925
287	NTIS (US Sales Only), PC A02/MF A01	DE83704373	MN -2	9:12926
289	NTIS (US Sales Only), PC A05/MF A01	DE83704374	MN -2	9:12927
294	NTIS (US Sales Only), PC A02/MF A01	DE83704375	MN -2	9:12928
303	NTIS (US Sales Only), PC A02/MF A01	DE83704335	MN -28	9:12591
304	NTIS (US Sales Only), PC A02/MF A01	DE83704331	MN -23	9:12725
IPNO-DRE-				
83-15	NTIS (US Sales Only), PC A02/MF A01; 1	DE84750479	MN -34C	9:12935
83-17	NTIS (US Sales Only), PC A02/MF A01; 1	DE84750478	MN -34C	9:12936

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83-18	NTIS (US Sales Only), PC A02/MF A01; 1	DE84750477	MN -34C	9:12933
83-22	NTIS (US Sales Only), PC A02/MF A01; 1	DE84750480	MN -34C	9:12940
ISU-ERI-AMES-				
83073	NTIS, PC A06/MF A01; 1	DE84005243	MN -60	9:11832
JINR-				
8-82-172	NTIS (US Sales Only), PC A02/MF A01	DE83704333	MN -38	9:12459
JINR-R-				
1-83-12	NTIS (US Sales Only), PC A02/MF A01	DE83704352	MN -37	9:12658
9-82-731	NTIS (US Sales Only), PC A02/MF A01	DE83704336	MN -28	9:12592
13-82-912	NTIS (US Sales Only), PC A02/MF A01	DE83704357	MN -37	9:12676
JPL-PUB-				
83-58	*See* DOE/CS/66001-1	DE84005796	STD -61a	9:11723
83-63	*See* DOE/ET/20356-8	DE84005609	STD -63	9:11756
83-73	*See* DOE/JPL/1060-63	DE84005610	STD -62	9:11760
83-74	NTIS, PC A08/MF A01	DE84005611	STD -95f	9:12265
83-86	*See* DOE/JPL/1012-91	DE84005612	STD -63b	9:11729
83-87	*See* DOE/JPL-1012-90	DE84005747	STD -63b	9:11728
83-89	*See* DOE/CS/66001-2	DE84005746	STD -95f	9:12407
83-90	*See* DOE/CS/66001-3	DE84005745	STD -61a	9:12200
83-94	*See* DOE/JPL/1012-93	DE84005741	STD -63b	9:11714
KFK-				
3403	NTIS (US Sales Only), PC A03/MF A01	DE84750078	MN -25	9:12432
3477	NTIS (US Sales Only), PC A05/MF A01	DE84750077	MN -11	9:12699
3569	NTIS (US Sales Only), PC A06/MF A01	DE84750079	MN -34D	9:12900
KFKI-				
1983-36	NTIS (US Sales Only), PC A02/MF A01	DE83704342	MN -80	9:11903
KVB-				
72-803428-1922	*See* PB-84-118918			9:12523
LA-				
9878-MS	NTIS, PC A02/MF A01	DE84006694	STD -28	9:12593
9939-PR	NTIS, PC A02/MF A01	DE84003558	STD -33A	9:11670
LA-UR-				
83-2940	NTIS, PC A02/MF A01; 1	DE84004048	MN -13	9:13073
83-2949	NTIS, PC A03/MF A01; 1	DE84001718	MN -78	9:12040
83-3451	NTIS, PC A02/MF A01	DE84003813	MN -78	9:12041
83-3634	NTIS, PC A02/MF A01; 1	DE84004312	MN -38	9:12095
LAL-				
83-10	NTIS (US Sales Only), PC A02/MF A01	DE84750429	MN -34D	9:12901
83-12	NTIS (US Sales Only), PC A07/MF A01	DE84750421	MN -34D	9:12902
83-21	NTIS (US Sales Only), PC A03/MF A01	DE84750466	MN -34D	9:12903
83-22	NTIS (US Sales Only), PC A02/MF A01	DE84750467	MN -34D	9:12904
LAL-RT-				
83-10	NTIS (US Sales Only), PC A02/MF A01	DE84750460	MN -28	9:12641
83-11	NTIS (US Sales Only), PC A02/MF A01	DE84750459	MN -28	9:12642
83-12	NTIS (US Sales Only), PC A02/MF A01	DE84750462	MN -28	9:12643
83-13	NTIS (US Sales Only), PC A02/MF A01	DE84750461	MN -28	9:12594
LBL-				
12675	NTIS, PC A04/MF A01	DE84004403	MN -64	9:12415
12959	NTIS, PC A03/MF A01	DE84004402	MN -64	9:12416
14555	NTIS, PC A03/MF A01	DE84004405	MN -64	9:11721
15298(Excerpt)	NTIS, PC A03/MF A01; 1	DE84004308	MN -11	9:12700
15525	NTIS, PC A15/MF A01	DE83015007	STD -32	9:13077
16145	NTIS, PC A02/MF A01	DE84005184	MN -20a	9:13004
16330	NTIS, PC A02/MF A01; 1	DE84005873	STD -32	9:13083
16366	NTIS, PC A04/MF A01; 1	DE84005867	STD -95d	9:12233
16530	NTIS, PC A02/MF A01	DE84005183	MN -25	9:12356
16578	NTIS, PC A04/MF A01	DE84006262	MN -70	9:11605
16613	NTIS, PC A03/MF A01; 1	DE84005182	MN -25	9:12357
16658	NTIS, PC A03/MF A01	DE84006266	MN -95d	9:12234
16753	NTIS, PC A02/MF A01	DE84005171	MN -4	9:12889
16754	NTIS, PC A02/MF A01	DE84005173	MN -4	9:12967
16770	NTIS, PC A05/MF A01	DE84005869	STD -95c	9:12235
16812	NTIS, PC A03/MF A01	DE84005877	STD -48	9:12427
16813	NTIS, PC A05/MF A01	DE84005861	STD -95d	9:12236
16850	NTIS, PC A03/MF A01	DE84005881	STD -94c	9:12103
16865	NTIS, PC A02/MF A01	DE84003388	MN -20a	9:13035
16889	NTIS, PC A02/MF A01; 1	DE84005196	MN -34D	9:12905
16925	NTIS, PC A03/MF A01; 1	DE84005868	STD -95d	9:12237
16937	NTIS, PC A03/MF A01; 1	DE84005546	MN -25	9:12677
16953	NTIS, PC A03/MF A01;1	DE84004058	MN -34D	9:12906
16954	NTIS, PC A02/MF A01	DE84005175	MN -4	9:12968
16972	NTIS, PC A02/MF A01	DE84005198	MN -25	9:12358
17014	NTIS, PC A03/MF A01	DE84005535	MN -25	9:12359
17131	NTIS, PC A; 3	DE84005713	MN -25	9:12890
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3021-Rev.	NTIS, PC A03/MF A01	DE84005545	MN -13	9:13064
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83-229	*See* AD-A-130665/3			9:12499
LYCEN-				
8301	NTIS (US Sales Only), PC A06/MF A01; 1	DE84750424	MN -34C	9:12929
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2369	*See* AD-A-133629/6			9:12250
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68	NTIS (US Sales Only), PC A02/MF A01	DE83704358	MN -37	9:12678
121	*See* PB-84-119601			9:11440

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3130	NTIS, PC A02/MF A01	DE84006222	STD -37	9:12679
MRL-R-				
873	*See* AD-A-131024/2			9:12449
MTR-				
83W9-01	*See* PB-84-100767			9:11734
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NASA-CR-				
168325	*See* DOE/NASA/0168-6	DE84005661	MN -96	9:12320
NASA-TM-				
83539	*See* DOE/NASA/51040-51	DE84005871	STD -96	9:12321
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83-2731	*See* PB-84-102128			9:11612
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72	*See* PB-84-105295			9:12696
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1674	*See* AD-A-133717/9			9:11700
ND-R-				
720	H.M.S.O., London, price Pound 3.00			9:11559
789(R)	NTIS (US Sales Only), PC A02/MF A01	DE83703884	MN -80	9:11904
912(R)	NTIS (US Sales Only), PC A04/MF A01	DE83704343	MN -80	9:11905
NE-				
01-84-Master-Index	Nuclear Standards Management Center, Oak Ridge, TN 37831		STD -80	9:11934
NE-C-				
8-6T-Rev.(11/ 83)	Nuclear Standards Management Center, Oak Ridge, TN 37830		STD -80	9:11925
NMERDI-				
2-71-4517	New Mexico Energy Research Development Inst., Information Center, Suite M, 457 Washington SE, Albuquerque, NM 87108		MN -58	9:11711
2-71-4634	Univ. of New Mexico, 117 Richmond Drive, N.E., Albuquerque, NM 87106		MN -37	9:12690
NP-				
4770069	NTIS (US Sales Only), PC A03/MF A01	DE84770069	MN -98	9:12164
4770070	NTIS (US Sales Only), PC A02/MF A01	DE84770070	MN -92	9:12180
4770071	NTIS (US Sales Only), PC A03/MF A01	DE84770071	MN -88	9:11480
4770072	NTIS (US Sales Only), PC A07/MF A01	DE84770072	MN -4	9:11671
4770073	NTIS (US Sales Only), PC A02/MF A01; 1	DE84770073	MN -90e	9:11843
4770074	NTIS (US Sales Only), PC A06/MF A01; 1	DE84770074	MN -90c	9:11413
4770075	NTIS (US Sales Only), PC A04/MF A01	DE84770075	MN -97a	9:12273
4770076	NTIS (US Sales Only), PC A08/MF A01	DE84770076	MN -38	9:12491
4770077	NTIS (US Sales Only), PC A06/MF A01; 1	DE84770077	MN -4	9:11672
4770078	NTIS (US Sales Only), PC A07/MF A01; 1	DE84770078	MN -38	9:12492
4770079	NTIS (US Sales Only), PC A08/MF A01; 1	DE84770079	MN -11	9:12720
4770080	NTIS (US Sales Only), PC A06/MF A01	DE84770080	MN -97a	9:11858
4770081	NTIS (US Sales Only), PC A11/MF A01; 1	DE84770081	MN -11	9:12748
4770082	NTIS (US Sales Only), PC A02/MF A01; 1	DE84770082	MN -13	9:11515
4770083	NTIS (US Sales Only), PC A02/MF A01	DE84770083	MN -13	9:11516
4770084	NTIS (US Sales Only), PC A03/MF A01; 1	DE84770084	MN -13	9:11517
4770085	NTIS (US Sales Only), PC A02/MF A01	DE84770085	MN -98	9:11518
4770086	NTIS (US Sales Only), PC A03/MF A01	DE84770086	MN -13	9:12146
4770087	NTIS (US Sales Only), PC A10/MF A01; 1	DE84770087	MN -48	9:12856
4770088	NTIS (US Sales Only), PC A10/MF A01	DE84770088	MN -59b	9:11789
4770089	NTIS (US Sales Only), PC A03/MF A01	DE84770089	MN -98F	9:11519
4770090	NTIS (US Sales Only), PC A05/MF A01; 1	DE84770090	MN -92	9:12181
4770091	NTIS (US Sales Only), PC A02/MF A01; 1	DE84770091	MN -25	9:12857
4770093	NTIS (US Sales Only), PC A04/MF A01; 1	DE84770093	MN -92	9:11520
4770152	NTIS (US Sales Only), PC A04/MF A01; 1	DE84770152	MN -95d	9:12238
4770153	NTIS (US Sales Only), PC A02/MF A01	DE84770153	MN -4	9:12411
4770154	NTIS (US Sales Only), PC A10/MF A01	DE84770154	MN -38	9:11844
4770155	NTIS (US Sales Only), PC A08/MF A01; 1	DE84770155	MN -38	9:12493
4770156	NTIS (US Sales Only), PC A05/MF A01; 1	DE84770156	MN -48	9:12806
4770157	NTIS (US Sales Only), PC A09/MF A01; 1	DE84770157	MN -41	9:12858
4770158	NTIS (US Sales Only), PC A02/MF A01	DE84770158	MN -13	9:12122
4900338	NTIS (US Sales Only), MF A01; 2	DE84900338	MN -98B	9:12182
4900644	NTIS, PC A04/MF A01; 1	DE84900644	MN -95d	9:12205
4900732	Tennessee Department of Economic and Community Development, Energy Div., Suite 707, 226 Capital Boulevard, Nashville, TN 37219		MN -98	9:11521
NSMRL-				
1006	*See* AD-A-131991/2			9:12451
NUREG-				
0020-Vol.7-No.9	NTIS, PC A19/MF A01 - GPO	DE84900693	MN -80	9:11869
0020-Vol.7-No.11	NTIS, PC A18/MF A01; 1 - GPO	DE84900514	MN -80	9:11870
0304-Vol.8-No.3	NTIS, PC A07/MF A01 - GPO	DE84900688	MN -2	9:11935
0325-Rev.6	NTIS, PC A04/MF A01 - GPO $4.25	DE84900652	MN -2	9:13065
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0519-Suppl.6	NTIS, PC A02/MF A01 - GPO $3.00	DE84900723	MN -78	9:12042
0540-Vol.5-No.8	NTIS, PC A99/MF A01; 1 - GPO	DE84900708	MN -2	9:11937
0675-Suppl.20	NTIS, PC A04/MF A01 - GPO $4.50	DE84900672	MN -78	9:12043
0675-Suppl.21	NTIS, PC A12/MF A01; 1 - GPO $7.00	DE84900665	MN -78	9:12044
0683-Suppl.1(Draft)	NTIS, PC A05/MF A01; 1 - GPO	DE84900666	MN -11	9:12819
0713-Vol.4	NTIS, PC A07/MF A01; 1 - GPO $5.00	DE84900660	MN -80	9:12045

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0748-Vol.3-No.9	NTIS, PC A15/MF A01; 1 - GPO	DE84900711	MN -80	9:11938
0748-Vol.3-No.10	NTIS, PC A15/MF A01; 1 - GPO	DE84900595	MN -80	9:11939
0748-VOL.3-NO.12	NTIS, PC A15/MF A01; 1	DE84900640	MN -80	9:11940
0750-Vol.17-Index.2	NTIS, PC A06/MF A01 - GPO	DE84900724	MN -80	9:11941
0793-Suppl.3	NTIS, PC A06/MF A01 - GPO $5.50	DE84900707	MN -78	9:12046
0797-Suppl.4	NTIS, PC A03/MF A01 - GPO $4.25	DE84900695	MN -78	9:12047
0820-Suppl.1	NTIS, PC A03/MF A01 - GPO $3.75	DE84900721	MN -78	9:12048
0837-Vol.3-No.2	NTIS, PC A07/MF A01 - GPO	DE84900671	MN -41	9:12717
0857-Suppl.5	NTIS, PC A06/MF A01 - GPO $5.00	DE84900694	MN -78	9:12049
0876-Suppl.3	NTIS, PC A03/MF A01 - GPO $3.75	DE84900719	MN -78	9:12050
0933	NTIS, PC A99/MF A01; 1 - GPO $16.00	DE84900648	MN -80	9:12051
0940-Vol.2-No.3	NTIS, PC A25/MF A01; 1	DE84900698	MN -2	9:11942
0957	NTIS, PC A10/MF A01 - GPO $6.50	DE84900696	MN -2	9:11943
0981	NTIS, PC A02/MF A01 - GPO $3.25	DE84900726	MN -80	9:12052
0995	NTIS, PC A06; 3 - GPO $5.00	DE84900657	MN -78	9:12053
1009	NTIS, PC A21/MF A01 - GPO $9.50	DE84900664	MN -78	9:11944
1013	NTIS, PC A21/MF A01 - GPO $9.50	DE84900596	MN -78	9:12054
1019	NTIS, PC A09/MF A01; 1 - GPO $6.00	DE84900586	MN -78	9:12055
1023	NTIS, PC A04/MF A01 - GPO $4.50	DE84900706	MN -78	9:12056
1024	NTIS, PC A03/MF A01 - GPO $3.75	DE84900709	MN -41	9:12057
1026	NTIS MF A01; 2 - GPO $6.50	DE84900653	MN -11	9:12750
1027	NTIS, PC A05/MF A01; 1 - GPO $4.50	DE84900697	MN -2	9:12753
1060	NTIS, PC A02/MF A01 - GPO $3.25	DE84900670	MN -41	9:12820
NUREG/BR-				
0051-Vol.5-No.3	NTIS, PC A03/MF A01 - GPO	DE84900690	MN -80	9:12058
NUREG/CR-				
2210	NTIS, PC A20/MF A01; 1 - GPO $9.50	DE84006094	MN -85	9:11575
2655	NTIS MF A01; 2 - GPO $8.00	DE82022267	MN -78	9:12059
2679-2	NTIS, PC A19/MF A01; 1 - GPO	DE84004667	MN -80	9:12060
2800-Suppl.2	NTIS, PC A18/MF A01; 1 - GPO $8.50	DE84005647	MN -80	9:12061
2815	NTIS, PC A11/MF A01 - GPO $6.50	DE84005744	MN -80	9:12062
3018	NTIS, PC A04/MF A01; 1 - GPO $4.50	DE84005653	MN -70B	9:11606
3049	NTIS, PC A03/MF A01 - GPO $3.75	DE84900710	MN -80	9:12063
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3143-Vol.1-Exec.Summ.	NTIS, PC A03/MF A01 - GPO $3.50	DE84900699	MN -70	9:11608
3143-Vol.3	NTIS, PC A08/MF A01 - GPO $5.50	DE84900703	MN -70	9:12869
3143-Vol.4	NTIS, PC A06/MF A01; 1 - GPO $5.00	DE84900700	MN -70	9:12870
3233	NTIS, PC A05/MF A01 - GPO $4.50	DE84004666	MN -78	9:12064
3314	NTIS, PC A99/MF A01; 1 - GPO $20.00	DE84900702	MN -78	9:12065
3342	NTIS, PC A04/MF A01 - GPO	DE84002897	MN -78	9:12066
3424	NTIS, PC A12/MF A01; 1 - GPO $7.00	DE84900712	MN -80	9:12067
3446	NTIS, PC A09/MF A01 - GPO $6.00	DE84900705	MN -11	9:12740
3454	NTIS, PC A03/MF A01 - GPO $3.75	DE84900713	MN -41	9:12821
3463	NTIS, PC A05/MF A01	DE84004276	MN -78	9:12068
3476	NTIS, PC A04/MF A01 - GPO	DE84005434	MN -12	9:11980
3510	NTIS, PC A04/MF A01; 1 - GPO $4.50	DE84005657	MN -70A	9:11609
3531	NTIS, PC A09/MF A01; 1 - GPO $6.00	DE84006680	MN -78	9:12069
3532	NTIS, PC A04/MF A01; 1 - GPO	DE84005649	MN -78	9:12387
3541	NTIS, PC A08/MF A01 - GPO $5.50	DE84900704	MN -80	9:12070
3543	NTIS, PC A03/MF A01 - GPO	DE84005047	MN -80	9:12071
3545	NTIS, PC A05/MF A01 - GPO $4.50	DE84900701	MN -70	9:12460
3555	NTIS, PC A05/MF A01; 1 - GPO $4.75	DE84900720	MN -11	9:12871
3557	NTIS, PC A03/MF A01	DE84004664	MN -80	9:11973
3568	NTIS, PC A08/MF A01 - GPO $5.50	DE84004656	MN -80	9:11945
3577	NTIS, PC A10/MF A01; 1 - GPO $6.50	DE84900662	MN -78	9:12072
3586	NTIS, PC A09/MF A01; 1 - GPO $6.00	DE84900668	MN -70	9:11610
3594	NTIS, PC A09/MF A01; 1 - GPO $6.00	DE84900654	MN -70	9:11611
3615	NTIS, PC A08/MF A01; 1 - GPO $5.50	DE84900655	MN -78	9:12494
NYSERDA-				
83-22	NTIS, PC A10/MF A01; 1	DE84005672	MN -94a	9:12098
OEFZS-				
4226	NTIS (US Sales Only), PC A04/MF A01	DE83703887	MN -78	9:12073
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163	NTIS, PC A02/MF A01	DE84005832	STD -70	9:11653
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5985	NTIS, PC A04/MF A01; 1	DE84005626	STD -70	9:11657
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216	*See* NUREG/CR-3543	DE84005047	MN -80	9:12071
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78-7559/ 5	NTIS, PC A03/MF A01	DE84004129	MN -59c	9:12239
79-24712/ 2	NTIS, PC A10/MF A01; 1	DE84006095	MN -95d	9:12240
ORNL/TM-				
8651	NTIS, PC A04/MF A01	DE84006246	MN -90d	9:11414
8925	NTIS, PC A04/MF A01	DE84006096	MN -90c	9:11415
8953	NTIS, PC A03/MF A01	DE84006241	STD -86	9:11564
8966	NTIS, PC A03/MF A01	DE84006207	MN -48	9:12799
8970	NTIS, PC A03/MF A01	DE84005082	MN -80	9:11984
9043	NTIS, PC A03/MF A01	DE84006245	STD -90d	9:11416
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4014-13	*See* DOE/ER/04014-13	DE84005142	MN -80	9:11981
OTA-TM-E-				
12	GPO		MN -98C	9:11536
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A 6-364,281		DE84006001	MN -25	9:12372
A 6-387,064		DE84006000	MN -4	9:12414
A 6-398,507		DE84006003	MN -28	9:12559
A 6-426,365		DE84005950	MN -83	9:11560
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83-256008	NTIS, PC A09/MF A01			9:12288
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83-256388	NTIS PC E04/MF E04			9:11790
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83-259622	NTIS, PC A07/MF A01			9:12244
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83-259879	NTIS PC E03/MF E03			9:12267
83-260323	NTIS PC E07/MF E07			9:12268
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83-261404	NTIS PC E03/MF E03			9:12463
83-261644	NTIS, PC A07/MF A01			9:11523
83-261768	NTIS, PC A05/MF A01			9:12702
83-262212	NTIS, PC A06/MF A01			9:12703
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83-262576	NTIS, PC A07/MF A01			9:11698
83-262782	NTIS			9:12135
83-262790	NTIS			9:12136
83-262808	NTIS			9:12137
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83-263319	NTIS PC E03/MF E03			9:11860
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83-263525	NTIS PC E05/MF E01			9:13036
83-263913	NTIS			9:12139
83-264200	NTIS, PC A06/MF A01			9:12704
83-264218	NTIS, PC A07/MF A01			9:12533
83-264440	NTIS, PC A05/MF A01			9:12723
83-264689	NTIS			9:12138
83-264788	NTIS PC E06/MF E01			9:11963
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84-100122	NTIS, PC A05/MF A01			9:12838
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84-104876	NTIS, PC A02/MF A01			9:11420
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84-115021	NTIS, PC A07/MF A01			9:12336
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84-118603	NTIS PC E04/MF E01			9:12960
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84-120351	NTIS, PC A09/MF A01			9:11550
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84-123397	NTIS, PC A03/MF A01			9:11540
84-123678	NTIS, PC A03/MF A01			9:11687
84-123686	NTIS, PC A02/MF A01			9:11688

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84-921000	Paper copy available on Standing Order, Deposit Account required. North American Continent price, $50.00/year; all others write for quote. Single copies also available in paper copy only. Basic report available as PB84-921099.			9:11667
84-921099	NTIS, PC A			9:11668
84-935500	Paper copy available on subscription, North American Continent price, $30.00/year; all others write for quote. Also available in single copies.			9:12822
84-936100	Paper copy available on subscription, North American Continent price, $30.00/year; all others write for quote. Also available in single copies.			9:12823
84-937600	Paper copy available on subscription, North American Continent price, $30.00/year; all others write for quote. Also available in single copies.			9:12800
84-939000	Paper copy available on subscription, North American Continent price, $30.00/year; all others write for quote. Also available in single copies.			9:12801
84-939100	Paper copy available on subscription, North American Continent price, $30.00/year; all others write for quote. Also available in single copies.			9:12802
PFC/CP-				
83-14	*See* DOE/ET/51013-105	DE84005076	STD -20	9:13030
PFC/RR-				
83-22	*See* DOE/ET/51013-93	DE84003360	STD -20	9:12985
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81/ 17	Fachinformationszentrum Energie, Physik, Mathematik, Karlsruhe (Germany, F.R.)			9:12908
PNL-				
4226	*See* NUREG/CR-2655	DE82022267	MN -78	9:12059
4297-Suppl.2	*See* NUREG/CR-2800-Suppl.2	DE84005647	MN -80	9:12061
4432-6	NTIS, PC A03/MF A01	DE84005442	MN -70B	9:11643
4640	NTIS, PC A06/MF A01; 1	DE84005334	STD -70	9:11613
4646	*See* NUREG/CR-3568	DE84004656	MN -80	9:11945
4686	NTIS, PC A04/MF A01	DE84005870	MN -70	9:11644
4747	NTIS, PC A07/MF A01	DE84005588	MN -70	9:11645
4798	*See* NUREG/CR-3510	DE84005657	MN -70A	9:11609
4889	NTIS, PC A08/MF A01; 1	DE84005883	MN -60	9:11824
4929	NTIS, PC A20/MF A01	DE84006267	MN -94e	9:12099
4939	NTIS, PC A04/MF A01	DE84005329	MN -13	9:13066
4970	NTIS, PC A02/MF A01	DE84006108	MN -94e	9:11804
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11125	NTIS, PC A03/MF A01	DE84005607	MN -85	9:12361
11404	NTIS, PC A03/MF A01	DE84005884	MN -25	9:12362
11651	NTIS (US Sales Only), PC A02/MF A01	DE84003354	MN -78	9:12074
11652	NTIS, PC A02/MF A01	DE84005890	MN -70A	9:11646
11687	NTIS, PC A02/MF A01	DE84005889	MN -48	9:12824
11774	NTIS, PC A02/MF A01	DE84003260	MN -11	9:12706
11865	NTIS, PC A02/MF A01	DE84005606	MN -70	9:11576
11904	NTIS, PC A02/MF A01	DE84005887	MN -85	9:11577
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2057	NTIS, PC A02/MF A01	DE84006282	STD -20a	9:13037
2059	NTIS, PC A05/MF A01	DE84006283	STD -20g	9:13005
2061	NTIS, PC A03/MF A01	DE84006285	STD -20	9:13006
2063	NTIS, PC A03/MF A01	DE84006279	STD -20	9:13007
2068	NTIS, PC A02/MF A01	DE84006284	STD -20f	9:13008
2070	NTIS, PC A02/MF A01	DE84006278	STD -20f	9:13009
2074	NTIS, PC A02/MF A01	DE84006277	STD -20a	9:13038
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11	NTIS, PC A02/MF A01	DE84006280	STD -20c	9:13039
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82-14	*See* PB-83-251751			9:11709
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3529	NTIS, PC A03/MF A01	DE84005829	STD -25	9:12344
RHO-BW-SA-				
299-P	NTIS, PC A02/MF A01; 1	DE84005682	MN -4	9:12412
327P	NTIS, PC A02/MF A01	DE84006037	MN -70	9:11614
328P	NTIS, PC A02/MF A01	DE84006034	MN -70	9:11615
330P	NTIS, PC A02/MF A01	DE84006040	MN -70	9:11616
332-P	NTIS, PC A02/MF A01; 1	DE84006041	MN -70	9:11617
RISO-M-				
2368	NTIS (US Sales Only), PC A03/MF A01	DE83703914	MN -70	9:11618
2374	NTIS (US Sales Only), PC A04/MF A01	DE83703920	MN -2	9:12147
RISO-R-				
481	NTIS (US Sales Only), PC A04/MF A01	DE83703867	MN -34B	9:12718
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82-038	*See* PB-83-243022			9:12660
83-014	NTIS (US Sales Only), PC A03/MF A01	DE83704337	MN -28	9:12595
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222/ 83	*See* OEFZS-4226	DE83703887	MN -78	9:12073
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305	NTIS (US Sales Only), PC A03/MF A01	DE83704360	MN -70	9:11619
306	NTIS (US Sales Only), PC A03/MF A01	DE83704348	MN -78	9:11965
307	NTIS (US Sales Only), PC A02/MF A01	DE83704367	MN -16	9:11658
SAM-TR-				
83-33	*See* AD-A-132941/6			9:12815

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SAND-				
82-0904-2	*See* NUREG/CR-2679-2	DE84004667	MN -80	9:12060
82-2417	NTIS, PC A03/MF A01	DE84001612	MN -13	9:12719
82-2429	*See* NUREG/CR-3233	DE84004666	MN -78	9:12064
82-2969/ 2	*See* NUREG/CR-3111/2	DE84004269	MN -70	9:11607
82-7131	NTIS, PC A07/MF A01	DE84005860	MN -63a	9:11739
83-0391	NTIS, PC A04/MF A01; 1	DE84005859	MN -70	9:11647
83-0581	NTIS, PC A03/MF A01; 1	DE84006098	MN -38	9:12507
83-1081	NTIS, PC A04/MF A01	DE84006099	MN -94cb	9:12104
83-1223	NTIS, PC A03/MF A01; 1	DE84005863	MN -13	9:12872
83-1416C	NTIS, PC A02/MF A01; 1	DE84005527	MN -25	9:12390
83-1451C	NTIS, PC A02/MF A01	DE84005524	MN -70	9:11620
83-1457C	NTIS, PC A02/MF A01; 1	DE84005513	MN -25	9:12385
83-1493C	NTIS, PC A02/MF A01; 1	DE84005553	MN -32	9:13040
83-1516C	NTIS, PC A02/MF A01; 1	DE84005514	MN -70	9:11621
83-1523	NTIS, PC A02/MF A01	DE84005507	STD -94a	9:12105
83-1682	NTIS, PC A02/MF A01; 1	DE84005879	MN -78	9:11906
83-1755C	NTIS, PC A02/MF A01	DE84005723	MN -92a	9:11494
83-1789	NTIS, PC A04/MF A01; 1	DE84005878	MN -32	9:12971
83-1797C	NTIS, PC A04/MF A01	DE84005519	MN -34	9:12961
83-1814	*See* NUREG/CR-3463	DE84004276	MN -78	9:12068
83-1863C	NTIS, PC A02/MF A01	DE84005550	MN -38	9:12516
83-1951C	NTIS, PC A02/MF A01	DE84001778	MN -13	9:13067
83-2098	*See* NUREG/CR-3532	DE84005649	MN -78	9:12387
83-2323C	NTIS, PC A02/MF A01	DE84005517	MN -63	9:11740
83-2325	NTIS PC E03/MF A01	DE84006250	MN -32	9:12681
83-2416C	NTIS, PC A02/MF A01	DE84004995	MN -66	9:11818
83-2655C	NTIS, PC A02/MF A01; 1	DE84005529	MN -94cb	9:12106
83-2665C	NTIS, PC A02/MF A01; 1	DE84005521	MN -38	9:12517
83-7467C	NTIS MF A01; 2	DE84005532	MN -94cb	9:12107
83-8239	NTIS, PC A02/MF A01; 1	DE84006205	MN -25	9:12363
83-8253	NTIS, PC A04/MF A01	DE84006275	MN -32	9:12495
83-25679C	NTIS, PC A02/MF A01	DE84005724	MN -34	9:12965
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1	*See* AD-A-131825/2			9:12674
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255-2168	NTIS, PC A02/MF A01	DE84000093	MN -59c	9:11802
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230-2065	NTIS, PC A05/MF A01; 1	DE84000012	STD -62e	9:11805
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215-2049	NTIS, PC A02/MF A01	DE84000018	STD -63	9:11741
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253-1662	NTIS, PC A03/MF A01	DE84000024	STD -59	9:11803
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80/ E/ 213	Available from Fachinformationszentrum Energie, Physik, Mathematik, Karlsruhe (Germany, F.R.)			9:12861
SKBF-KBS-TR-				
82-03	NTIS (US Sales Only), PC A04/MF A01	DE83703869	MN -48	9:11648
82-04	NTIS (US Sales Only), PC A04/MF A01	DE83703870	MN -48	9:11649
82-05	NTIS (US Sales Only), PC A05/MF A01	DE83703871	MN -48	9:11650
82-08(Pt.1)	NTIS (US Sales Only), PC A03/MF A01	DE83703915	MN -70	9:11622
82-18	NTIS (US Sales Only), PC A03/MF A01	DE83704361	MN -70	9:11623
82-20	NTIS (US Sales Only), PC A05/MF A01	DE83704362	MN -70	9:12873
82-21	NTIS (US Sales Only), PC A04/MF A01	DE83704363	MN -70	9:11624
82-23	NTIS (US Sales Only), PC A03/MF A01	DE83704364	MN -70	9:11625
82-25	NTIS (US Sales Only), PC A02/MF A01	DE83704365	MN -70	9:11626
82-26	NTIS (US Sales Only), PC A03/MF A01	DE83704366	MN -70	9:11627
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10	NTIS, PC A02/MF A01	DE84005896	MN -28	9:12567
11	NTIS, PC A03/MF A01	DE84005895	MN -28	9:12568
12	NTIS, PC A03/MF A01	DE84005894	MN -28	9:12569
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263	*See* DOE/SF/00515-T25	DE84005841	MN -28	9:12563
SLAC-PEP-NOTE-				
132	NTIS, PC A02/MF A01; 1	DE84003216	MN -28	9:12570
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3250	NTIS, PC A03/MF A01; 1	DE84005327	MN -34D	9:12878
3259	NTIS, PC A02/MF A01	DE84005425	MN -34	9:12972
3260	NTIS, PC A02/MF A01	DE84005423	MN -34D	9:12909
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98576	*See* PB-84-104926			9:11466
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83-20	NTIS, PC A07/MF A01; 1	DE84005640	MN -32	9:13078
83-21	NTIS, PC A02/MF A01; 1	DE84005639	MN -32	9:12973
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063	*See* DOE/SF/10501-003	DE84004788	MN -58b	9:11761
605	*See* DOE/SF/10501-305	DE84004537	MN -58c	9:11768
737	*See* DOE/SF/10501-137	DE84004535	MN -58c	9:11762
738	*See* DOE/SF/10501-138	DE84004536	MN -58c	9:11763
739	*See* DOE/SF/10501-139	DE84004786	MN -58c	9:11764
740	*See* DOE/SF/10501-140	DE84004784	MN -58c	9:11765
741	*See* DOE/SF/10501-141	DE84004800	MN -58c	9:11766
742	*See* DOE/SF/10501-142	DE84004801	MN -58c	9:11767
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82-364	*See* SKBF-KBS-TR-82-18	DE83704361	MN -70	9:11623

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SUNI-				
76	NTIS (US Sales Only), PC A05/MF A01	DE83704376	MN -2	9:12874
TR-				
15	*See* AD-A-132698/2			9:12376
20	*See* AD-A-130913/7			9:12447
21	*See* AD-A-130914/5			9:12448
TRITA-EPP-				
82-02	NTIS (US Sales Only), PC A03/MF A01	DE83703868	MN -34B	9:12882
TTC-				
0449	*See* HEDL-7376	DE84005300	MN -70	9:11572
TU-Inf-				
05-06-81	NTIS (US Sales Only), PC A02/MF A01	DE83704353	MN -37	9:12662
05-10-81	NTIS (US Sales Only), PC A02/MF A01	DE83704354	MN -37	9:12663
05-13-81	NTIS (US Sales Only), PC A02/MF A01	DE83704355	MN -37	9:12664
UBA-FB-				
80-012	Available from Umweltbundesamt, Berlin (Germany, F.R.)			9:12742
82-124	Available from Umweltbundesamt, Berlin (Germany, F.R.)			9:12534
UCID-				
19785-84	NTIS, PC A03/MF A01	DE84006224	MN -11	9:12868
19912	NTIS, PC A04/MF A01; 1	DE84002678	MN -38	9:13079
19927	NTIS, PC A02/MF A01	DE84004758	MN -80	9:11874
19932	NTIS, PC A02/MF A01; 1	DE84005116	MN -38	9:12969
19950	NTIS, PC A03/MF A01	DE84005110	MN -38	9:12442
19956	NTIS, PC A03/MF A01	DE84005113	MN -13	9:13084
19959	NTIS, PC A02/MF A01	DE84005891	MN -25	9:12391
19963	NTIS, PC A02/MF A01	DE84004757	MN -80	9:11875
19970	NTIS, PC A03/MF A01	DE84006261	MN -25	9:12364
19976	NTIS, PC A04/MF A01	DE84005221	MN -70	9:11578
19980	NTIS, PC A03/MF A01	DE84006264	MN -34	9:12949
19982	NTIS, PC A03/MF A01	DE84006226	MN -70	9:12682
19983	NTIS, PC A02/MF A01	DE84006126	MN -25	9:12365
19984	NTIS, PC A02/MF A01	DE84006265	MN -20c	9:13041
19985	NTIS, PC A03/MF A01	DE84005596	MN -11	9:12707
19986	NTIS, PC A02/MF A01	DE84006271	MN -78	9:12075
19989	NTIS, PC A03/MF A01	DE84006227	MN -38	9:12464
19994	NTIS, PC A02/MF A01	DE84006259	MN -38	9:12665
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SV El Salvador
SY Syria
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TC Trucial Oman
TD Chad
TG Togo
TH Thailand
TN Tunisia
TO Tonga
TR Turkey
TT Trinidad and Tobago
TW Taiwan
TZ United Republic of Tanzania

UA Ukrainian Soviet Socialist Republic (Ukrainian SSR)
UG Uganda
US United States of America (USA)
UY Uruguay

VA Holy See
VD Democratic Republic of Vietnam
VE Venezuela
VS Republic of Vietnam

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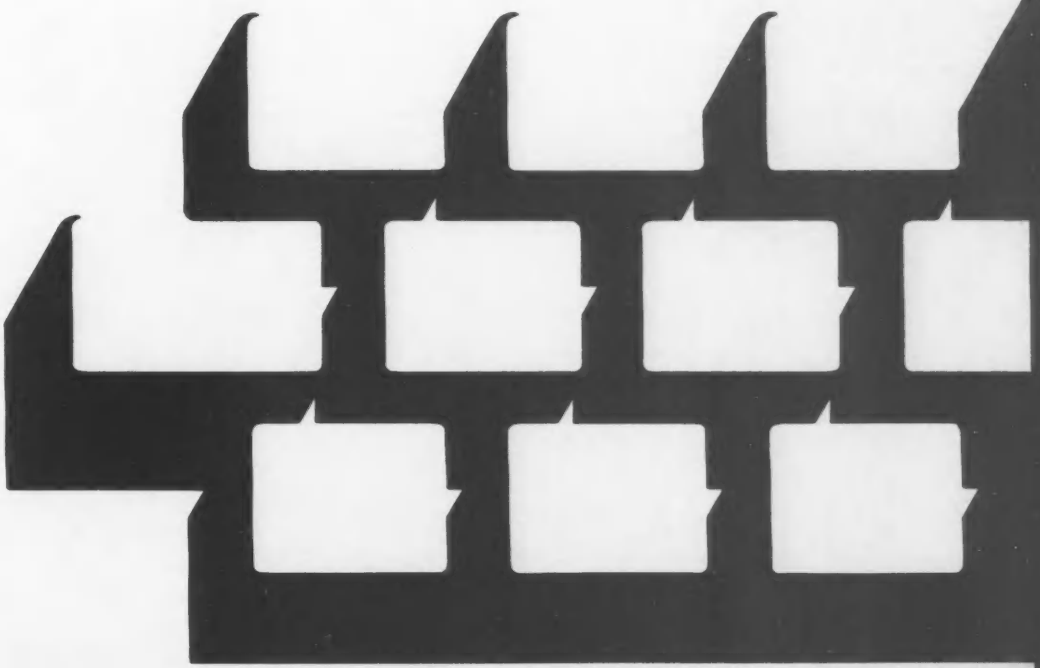

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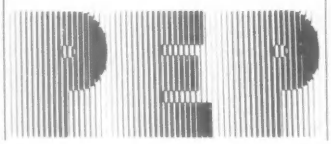

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